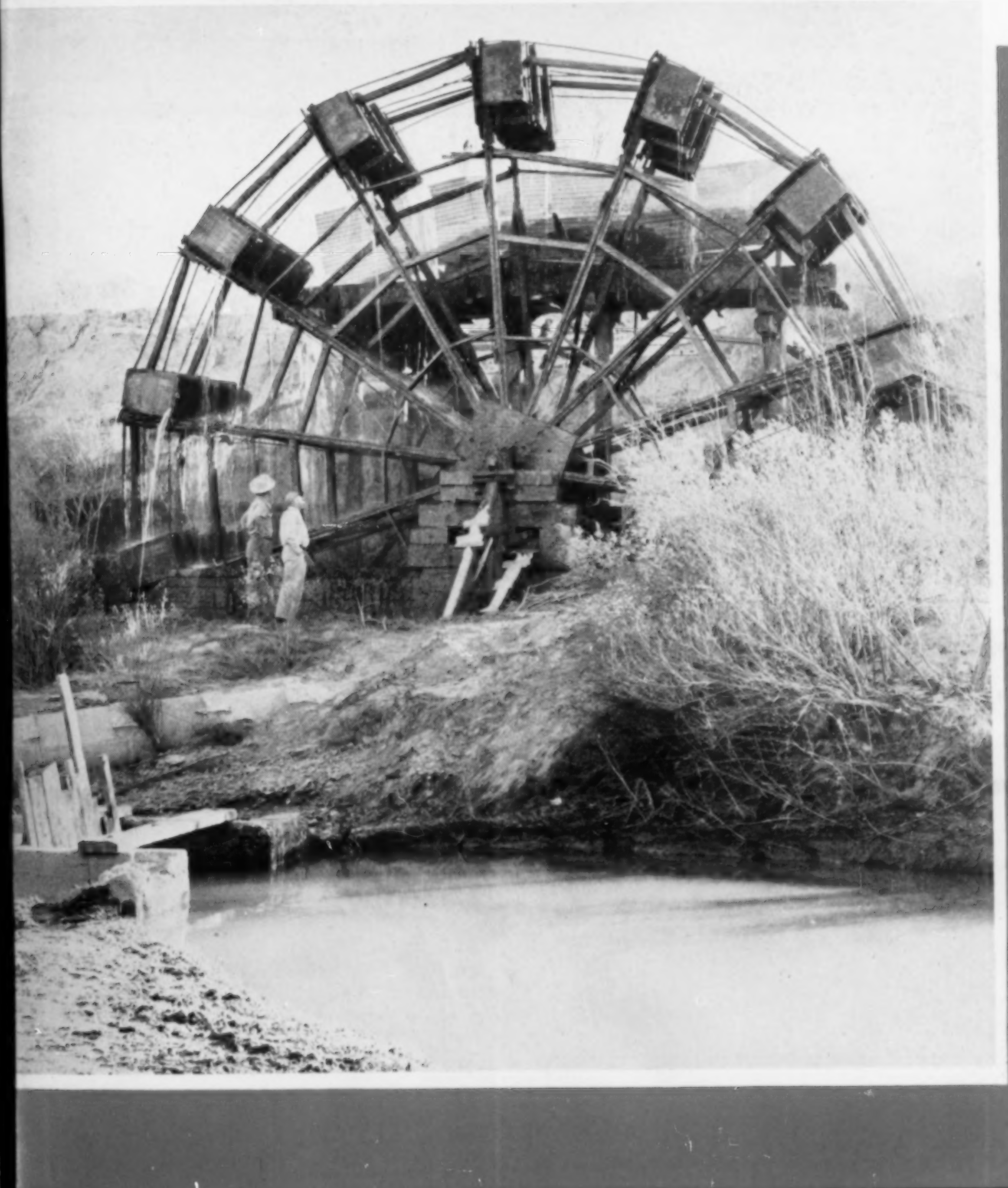
Compressed Air Magazine

DECEMBER 1947



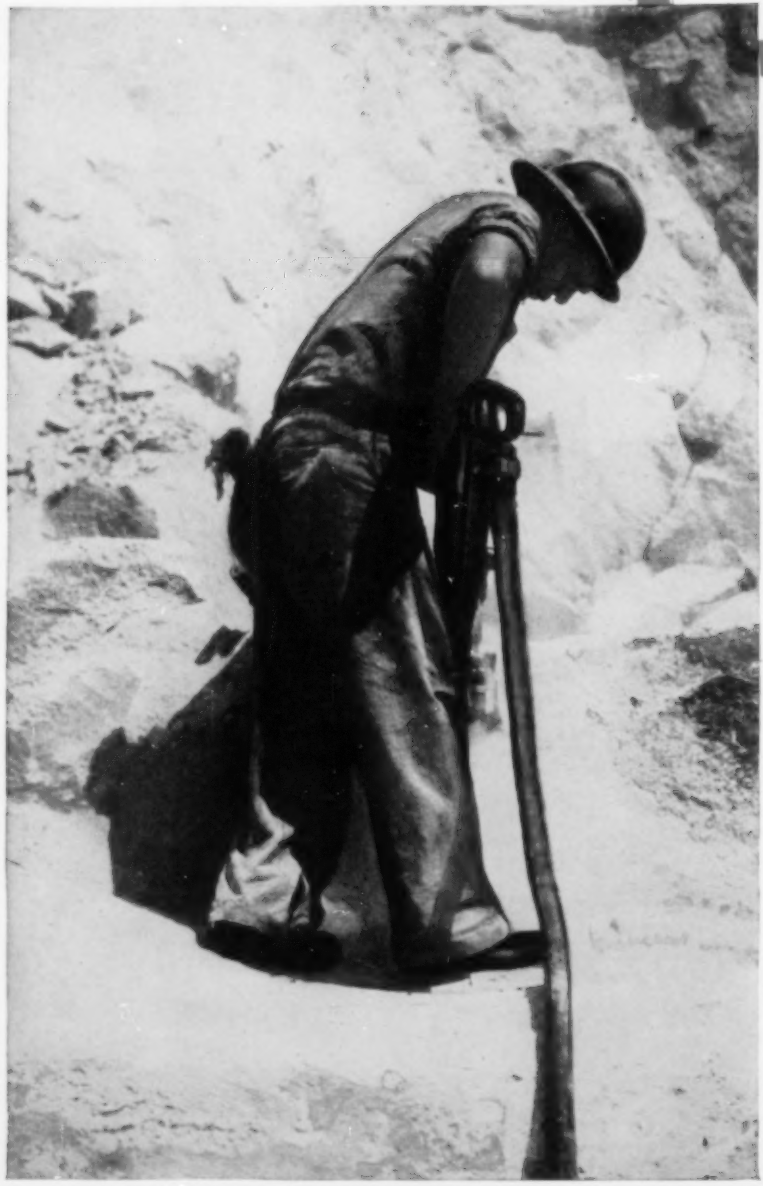
PRIMITIVE PUMP ON NEVADA FARM

Wheel such as ancients used raises water from river to irrigate land

VOLUME 52 · NUMBER 12 NEW YORK · LONDON

THIS OIL "MAKES" YOUR DRILLS...

- turn in more footage
- require less servicing
- last much longer

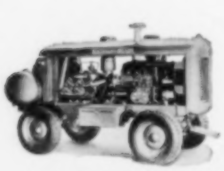


YOU can drill more footage per shift . . . and your drills will last longer, require less servicing . . . when you use Texaco Rock Drill Lubricants E.P.

Texaco Rock Drill Lubricants E.P. are especially made to keep rock drills working at their best. Their "extreme pressure" characteristics are more than ample to protect moving parts even under the severest conditions. They resist oxidation, flow readily, prevent rust and corrosion whether drills are running or idle.

Texaco Rock Drill Lubricants E.P. are approved by leading rock drill manufacturers. Use the grade recommended for your particular drills and operating conditions.

A Texaco Lubrication Engineer will gladly work with you. Just call the nearest of the more than 2500 Texaco distributing plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.



KEEP COMPRESSORS EFFICIENT

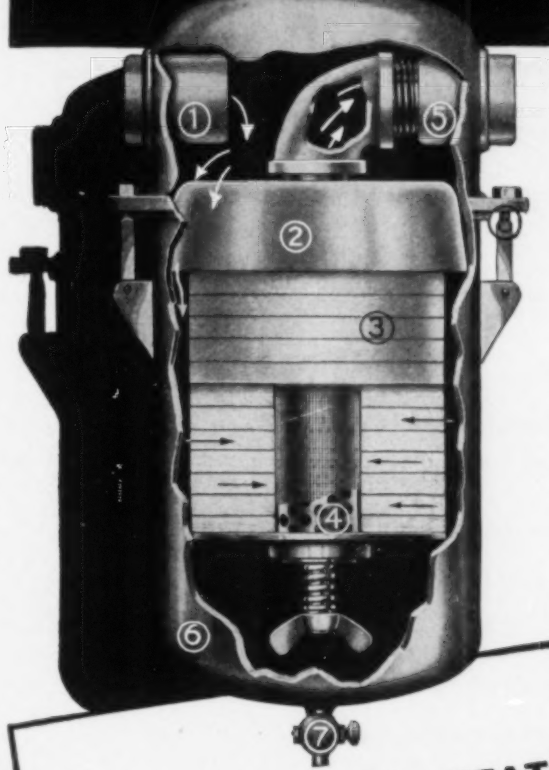
Assure clean valves, free rings, clear ports and air lines by lubricating with *Texaco Alcaid, Algol or Ursa Oil.* A Texaco Lubrication Engineer will gladly recommend the right one to assure the most efficient, economical compressor operation.

TEXACO

TEXACO Rock Drill Lubricants E. P.

TUNE IN . . . TEXACO STAR THEATRE presents the TONY MARTIN SHOW every Sunday night. • METROPOLITAN OPERA broadcasts every Saturday afternoon.

HAZARD of Oil and Moisture in Automatic Controls NOW ELIMINATED



New Filter Delivers Dry Air Only

Amazing results are being reported by users of the Model AAPHS Pipe Line Filter as a final stage in the protection of delicate pneumatic control instruments.

Typical comment is that of a large producer of electric and steam power who says, "We tried several well-known methods of moisture and oil elimination without satisfactory results. Your Model AAPHS was finally installed in the air line and since then we have had no trouble whatever with oil or moisture in our automatic controls."

Write for Complete Data.

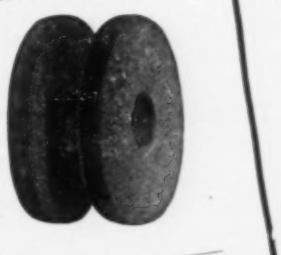
DOLLINGER CORPORATION
7 CENTRE PARK, ROCHESTER 3, N. Y.

IN CANADA: McCarthy and Robinson, Toronto
Engineering Equipment Co., Montreal

DOLLINGER
PROTECTOMOTOR
STAYNEW FILTERS

CONSTRUCTION FEATURES

(1) inlet, (2) baffle that distributes vapor-laden air to sides of container (6), (3) felt rings, (4) perforated liner, (5) outlet, (7) drain cock, (8) swing bolts for easy inspection (optional).



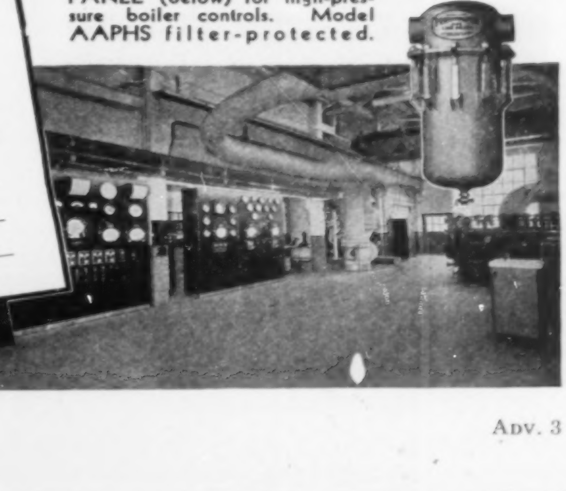
THICK FELT RINGS that remove every trace of oil or moisture.

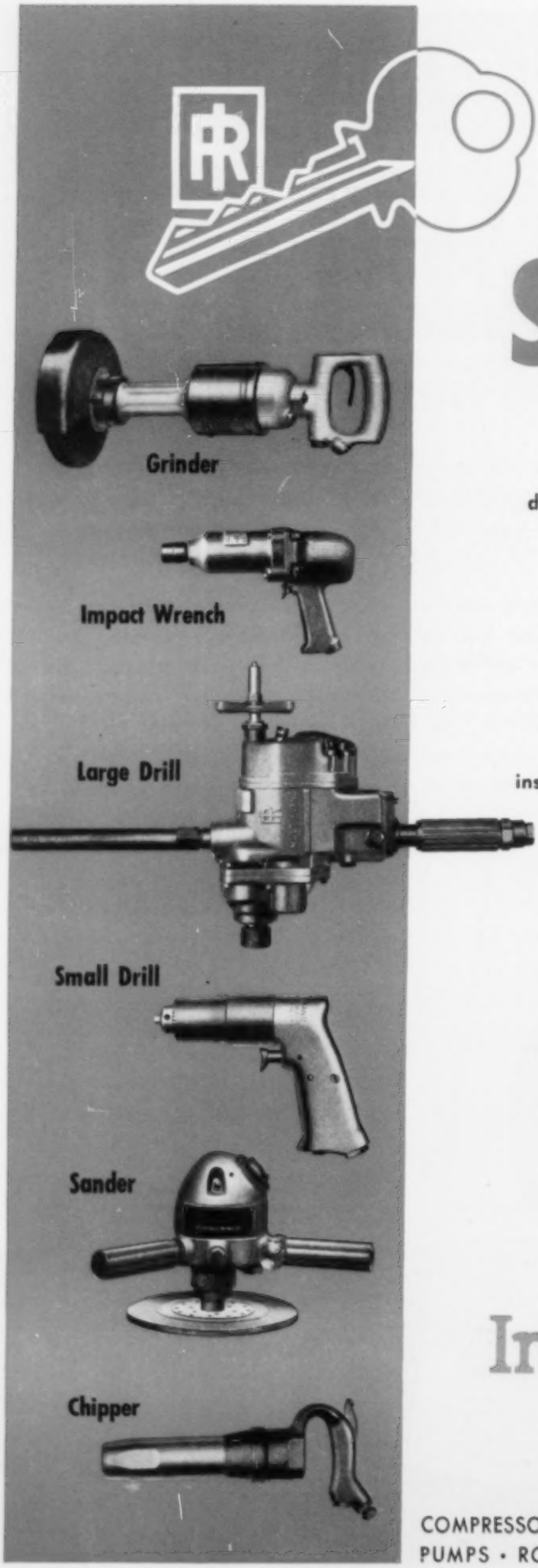
SPECIFICATIONS

Model	Standard Pipe Size	Capacity	Model	Standard Pipe Size	Capacity
AAPH-02 AAPHS-02	¼"	5 CFM	AAPH-2 AAPHS-2	1"	30 CFM
AAPH-01 AAPHS-01	¼"	7 CFM	AAPH-4 AAPHS-4	1½"	50 CFM
AAPH-0 AAPHS-0	½"	10 CFM	AAPH-5 AAPHS-5	2"	100 CFM
AAPH-1 AAPHS-1	¾"	20 CFM			

Letter S in code numbers indicates swing-belt type which facilitates inspection.

PANEL (below) for high-pressure boiler controls. Model AAPHS filter-protected.





KEY to Success

Success means
doing a *better* job. You can turn out better jobs
quicker and at less cost,
if you figure your job with
I-R Air Tools.

Ingersoll-Rand Air Tools give you
operator control—
instantaneous (or gradual) starting and stopping.
In addition,
they are light in weight, easy to handle,
and reduce operator fatigue.
Their durability, flexibility, and
control insure superior work with
reduced maintenance and operation costs.

Your jobs will be *better*
and more profitable with I-R Air Tools.
For complete information,
consult our nearest representative.

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COMPRESSORS • CONDENSERS • TURBO BLOWERS • CENTRIFUGAL PUMPS • ROCK DRILLS • AIR TOOLS • OIL AND GAS ENGINES

90% OF ALL V-BELT DRIVE PROBLEMS SOLVED ECONOMICALLY WITH TEXROPE

Pre-Engineered Drives

Stock Texrope Drives
TEXSTEEL OR TEXDRIVE SHEAVES
1150 RPM MOTOR
3

This New Manual Lists them for Quick Reference

You find number, size and length of belts, diameters of sheaves, power, speed, center distances in one place.

Edge index and classified index make this manual, fast, easy to use. It's a complete V-belt drive reference work.

Complete V-belt drive engineering data tables are included in manual, for figuring special drives.

USING STOCK BELTS AND SHEAVES, Texrope engineers have selected the *best* drive for each requirement . . . the drive most economical in first cost and in maintenance.

Only Allis-Chalmers offers you this complete Pre-Engineered drive manual. It is the product of 23 years of industrial V-belt drive experience, the finest engineering talent in the business.

Here is a book that will save you time and money in the purchase of V-belt drive equipment. Copies have been sent to many Texrope users and dealers. If you don't have a copy yet, write for Texbook No. 20P40. ALLIS-CHALMERS, MILWAUKEE 1, WIS.

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TEXROPE ..Greatest Name in V-Belt Drives

"Super 7" V-BELTS
Five Types — Sizes to suit every power transmission job.

Texsteel, Texdrive, "Magic-Grip"
— sheaves in a full range of sizes, grooves.

"Vari-Pitch" SHEAVES
Exact variations in speed, stationery or motion control.

SPEED CHANGERS
Speed variations up to 375% at the turn of a crank.

ENGINEERING
Finest V-Belt engineering talent in the world—at your call.

TEXROPE "Super 7" V-Belts result from the cooperative research of two great companies—Allis-Chalmers and B. F. Goodrich. They are sold only by A-C.

Texrope, Super-7, Texsteel, Texdrive, Magic-Grip and Vari-Pitch are Allis-Chalmers Trademarks

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

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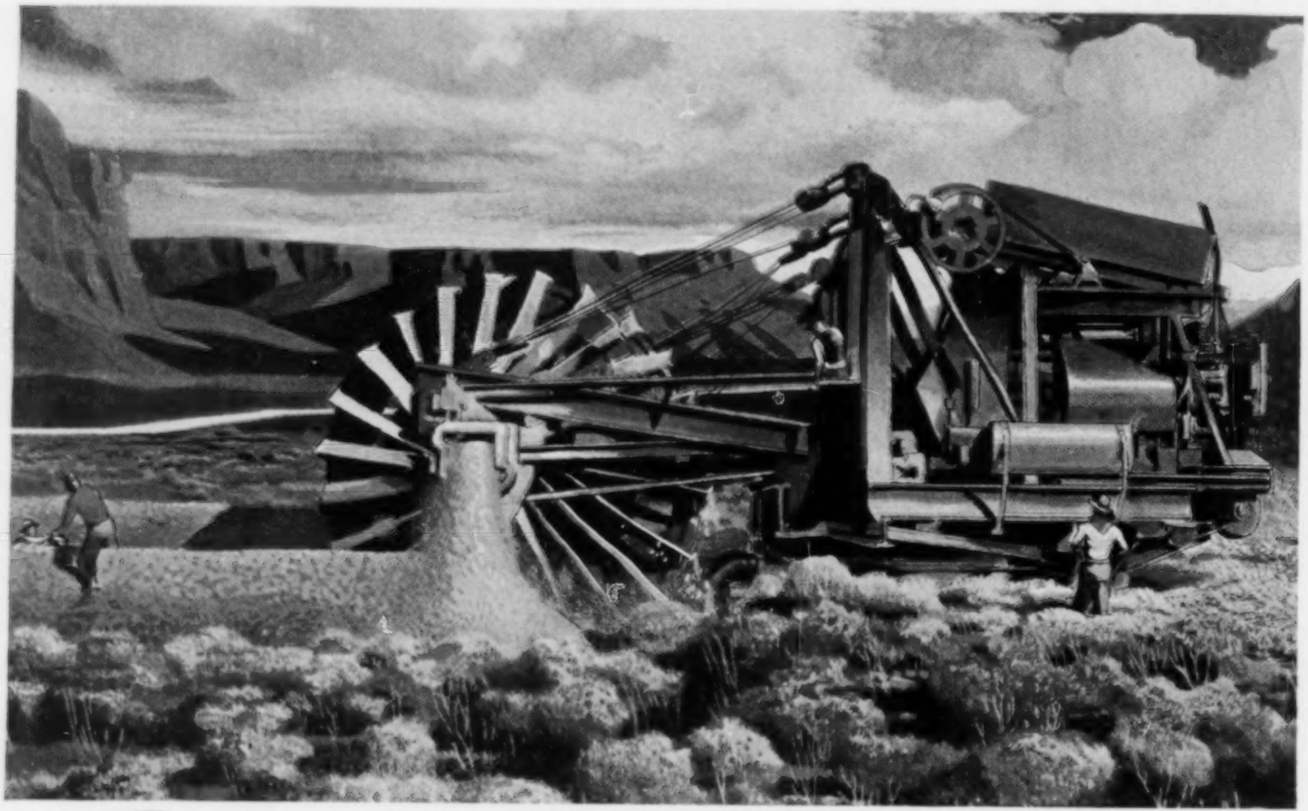
A CENTURY OF SERVICE to Industry THAT MADE America Great

What's The Limit?

On the job day and night, giant canal-diggers scoop out a canal 16 feet wide at the rate of a foot a minute to bring water to half a million acres of Arizona desert. Does this mean it is now possible to irrigate all the arid regions of our Southwest? What's the limit?



IS *Porous Chrome* THE ENGINE-LIFE PISTON RING?

From the performance of millions of these rings now in service, it looks possible! In all types of internal combustion engines, Koppers Porous Chrome* multiplies piston ring life by four—even *five!*

You use them only in the upper compression grooves. Their gentle honing action causes the entire set to seat within the first hour of operation, eliminating the costly and destructive break-in period, cutting cylinder wear in half!

These amazing piston rings are produced for all types of gasoline and Diesel compressor equipment. Specify them on new equipment. Use them on overhauls. For more specific details on your motor, address Koppers Company, Inc., Piston Ring Division, Box 626, Baltimore 3, Maryland.

*Van der Horst Process

K KOPPERS

American Hammered
Piston Rings

IN EVERY SIZE—OF EVERY TYPE—FOR EVERY PURPOSE

Eimco's Standard Loading Equipment In The Iron Mining Districts

Important underground mines of the Iron Mining districts of the world depend on Eimco RockerShovels to maintain their standards of development and production.

Hundreds of thousands of tons of ore loaded every hour of every day by Eimco RockerShovels prove the dependability of these machines. RockerShovels are preferred by management and operators alike for their long uninterrupted service and easy operation.

World's records of tunnel advance in contract work and operating mines are held by men who have used Eimco loading equipment exclusively.

RockerShovels load faster at a lower cost per ton loaded than any other loading equipment. Write for information on Eimco RockerShovels.

Eimco RockerShovel

EIMCO

THE EIMCO CORPORATION

The World's Largest Manufacturer of Underground Rock Loading Machines

Executive Offices and Factories: Salt Lake City 8, Utah:
Branches — 67 Wall St., New York 5 — 3319 So. Wallace St., Chicago 16 — Mills Bldg., El Paso — 1217 - 7th St., Sacramento 14
Birmingham 9, Alabama — 110 Malaga

A158

It's good steel
to work with—
thanks to
CONTROLLED
HARDENABILITY

The average blacksmith doesn't give a thought to Controlled Hardenability.* He's interested in how the drill steel makes up. He wants easy forging, a wide quenching range, a smooth center hole . . . above all, a steel that's uniform from bar to bar.

But whether the blacksmith knows it or not, Controlled Hardenability is one of the big reasons why Bethlehem Hollow is all a drill steel should be. The skillful blending of ingredients in the melting furnace is the first important phase in exercising close control of hardenability and other physical properties of the steel. The production technique that follows is based at every stage on producing steel that is uniform in behavior—tough, fatigue-resisting drill steel.

Every pound of Bethlehem Hollow is made to the same, undeviating quality. Whether you're using detachables or forged-on bits, you can depend on it for extra footage and lower costs.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

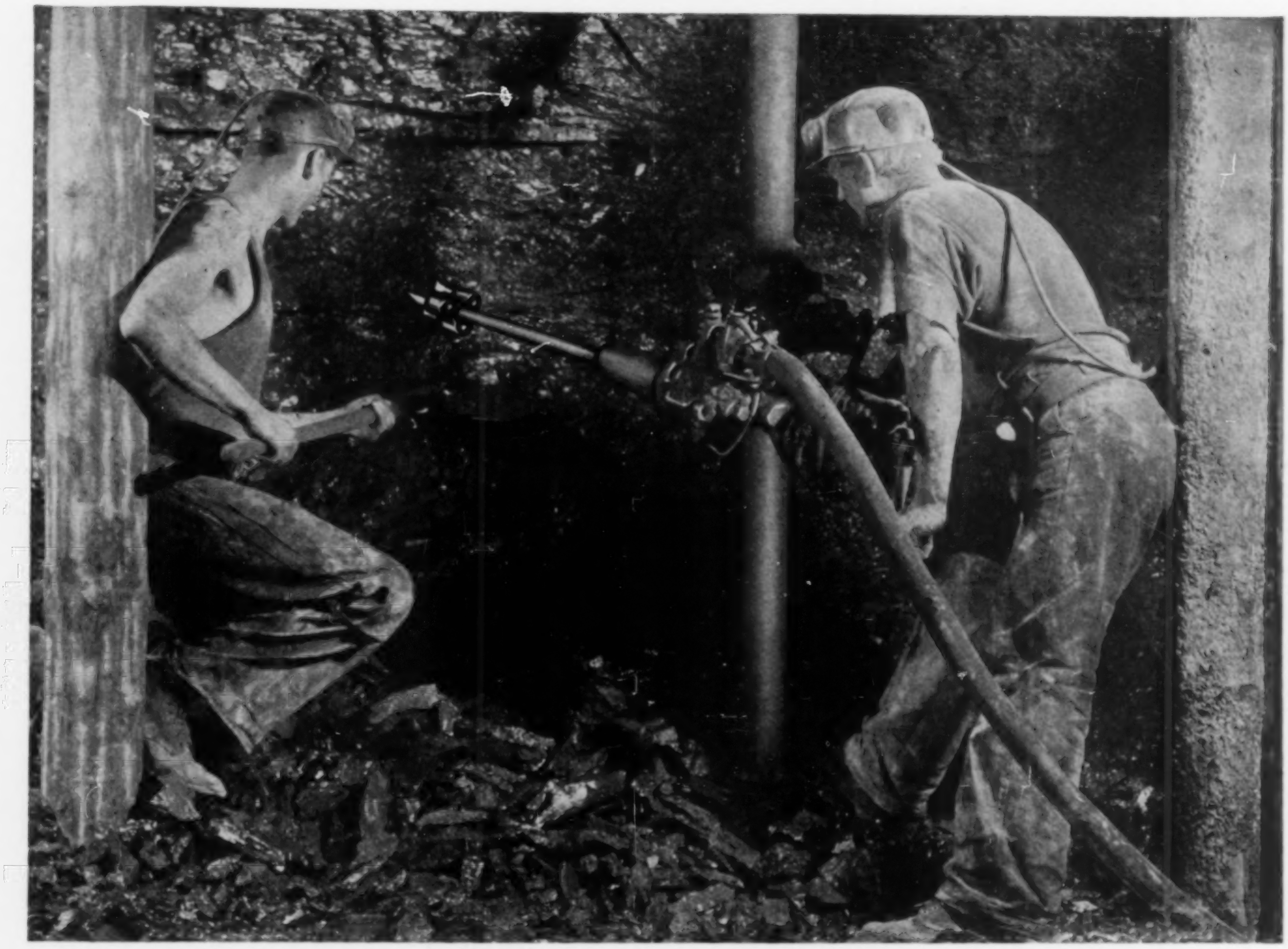
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Export Distributor: Bethlehem Steel Export Corporation

★ BETHLEHEM STEEL ★

**A technique for controlling the ability of steel to be hardened "in depth."*

BETHLEHEM HOLLOW DRILL STEEL



Mining Coal or Soft Formations

WITH "RADIALAXE" COAL CUTTERS

THE "Radialaxe" has increased coal output and reduced mining costs in many collieries. Investigate the possibilities of this simple and economical Coal Cutter in relation to your own mining operations.

"Radialaxe" Air-Driven Coal Cutters are used for driving entries, overcutting, undercutting, shearing, taking down roof, working out dirt or clay bands, and other coal mining operations.

These versatile machines have also been successfully employed for mining limestone, talc, soapstone, phosphate, marble or other soft minerals.

Further information regarding Canadian Ingersoll-Rand "Radialaxe" Coal Cutters and their application may be obtained from Ingersoll-Rand branches throughout the world.

Canadian Ingersoll-Rand Co. Limited
head office · MONTREAL QUE. —— *works* · SHERBROOKE QUE.
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H-27

AGAIN COSTS COUNT

. . . and that goes for compressed air, too!

Air isn't free. It never was, if you're thinking about compressed air. It costs money to buy good compressors, and to buy the power to run them. And costs today are increasingly important, all through the plant.

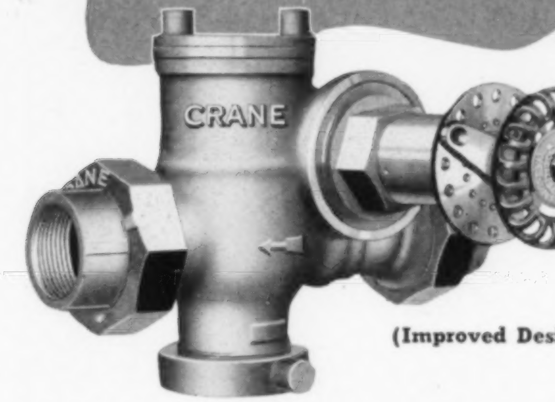
If you want the most for your power dollar—the greatest efficiency from your compressors—use leather belting, whose effectiveness for compressor drives and other tough power deliveries cannot be surpassed.

We make VIM Tred and Okay Tred Leather Belting, using the exclusive patented tread which reduces slip to a very minimum. It's tough, long-lived, flexible over small pulleys, a belt with 40 years of leather craftsmanship behind it. May we estimate on your next compressor belting job? E. F. Houghton & Co., Philadelphia, Chicago, Detroit, San Francisco and all other principal cities.

Buy VIM Tred Leather by the roll or by the belt, made endless by our expert beltmakers. Ask The Houghton Man.

Houghton's TREADED LEATHER BELTING

AVAILABLE FOR IMMEDIATE DELIVERY . . .



(Improved Design)

NO. 960 BRASS PRESSURE REGULATOR

1. For initial steam or air pressures up to 250 lbs., reduced to within 80%. Sizes up to 2 in.
2. Can't wear out; every working part is renewable. Piston operates in removable cylinder liner.
3. Can be furnished for any of four service pressure ranges: 1 to 10, 5 to 30, 20 to 100, 90 to 200 pounds. Setting within each pressure range is by simple hand-wheel adjustment. Operation is completely automatic.
4. Maintains uniform reduced pressure at all times. Pressure cannot build up.
5. Simplified design: has minimum working parts. Fully accessible for inspection. Easy to service.

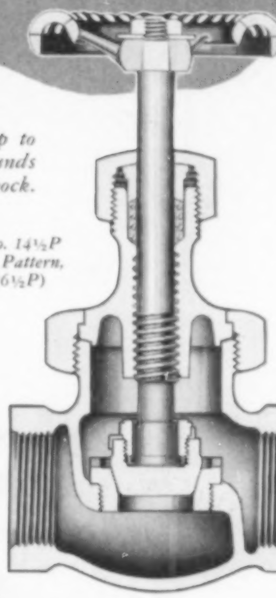
How to Choose the Right Size

For best results, having the right size pressure regulator for your needs is all-important. Get this folder with its handy size selector, and other data to help you order. Or, see your Crane catalog, p. 410-411.

WRITE FOR DESCRIPTIVE FOLDER AD-1597

BEST FOR TOUGH SERVICES!

Working Pressures: *Up to 150 pounds steam; 300 pounds cold water, oil, or gas, non-shock.*



Cat. No. 14½P (Angle Pattern, No. 16½P)

150-POUND PLUG TYPE DISC BRASS GLOBE AND ANGLE VALVES

WHERE TO USE THEM

Recommended for all spots where flow is throttled, and where operating conditions are severe. Ideal for soot blower, blow-off, boiler feed, drip and drain lines.

WHY THEY GIVE BETTER SERVICE

They are designed throughout for tough work. Plug type disc and seat provide extra-wide bearing surfaces for maximum resistance to wire-drawing and damage by foreign matter. Taper of disc permits easy regulation of flow.

Seating materials (Crane Nickel Alloy to Exelloy) are harder, tougher, and stronger than metals ordinarily used in brass valves. They have higher resistance to wear, temperature, galling, and scoring. See your Crane catalog, p. 31 or

WRITE FOR DESCRIPTIVE CIRCULAR AD-1668

CRANE CO., *General Offices,* 836 South Michigan Avenue, Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

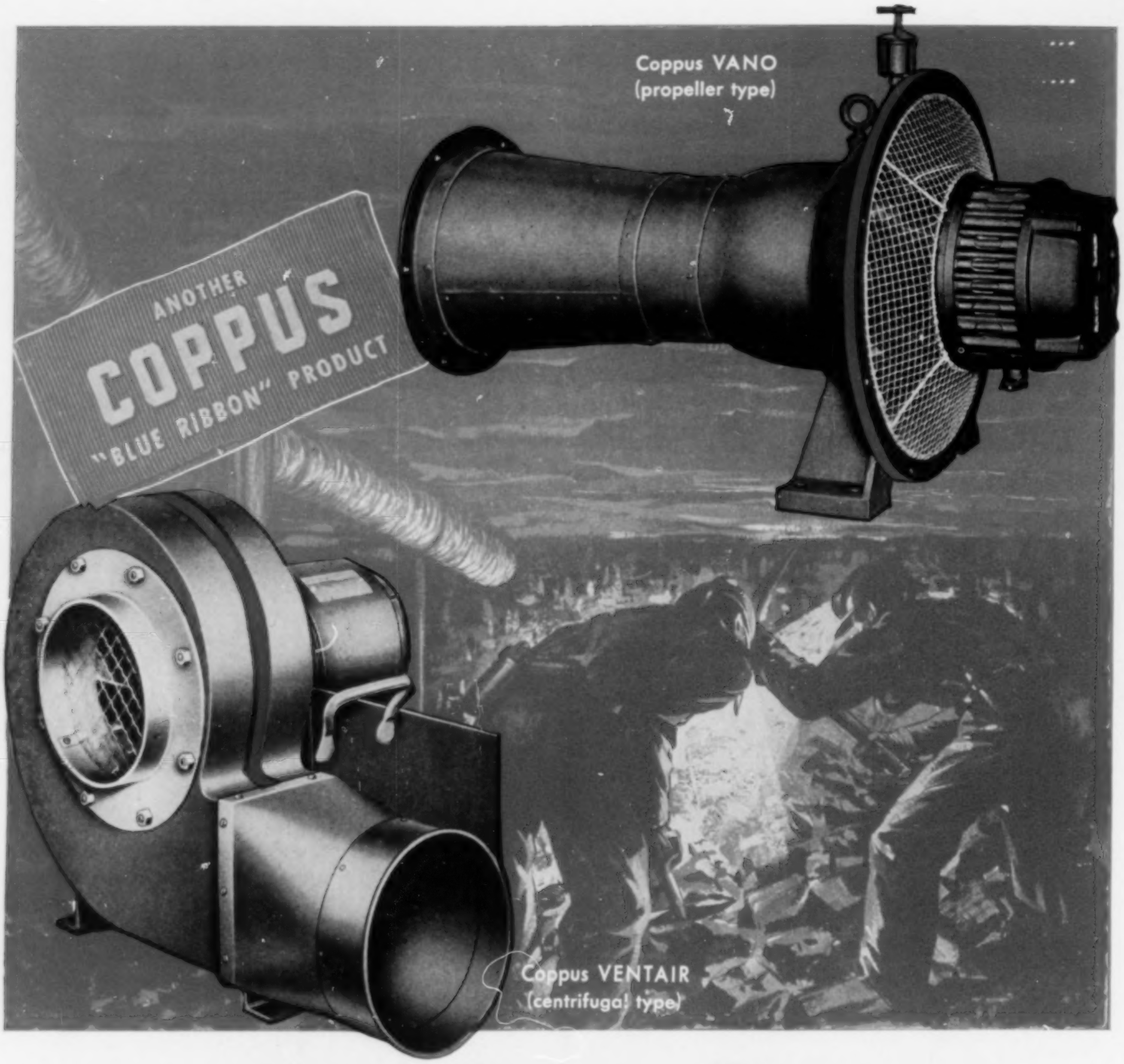
EVERYTHING FROM . . .

VALVES
FITTINGS
PIPE

CRANE

PLUMBING
AND
HEATING

FOR EVERY PIPING SYSTEM



Choose Between Them and Get 30% to 100% More Air

Coppus Blowers are designed for two different types of mine ventilation requirements: the centrifugal Coppus VENTAIR is for long pipe lines; the propeller-type Coppus VANO for shorter lines . . . the correct selection will give you from ⅓ more to twice as much air — for a given power consumption — than an ordinary all-purpose fan.

Available for either compressed air or electric motor drive, both can be used as blowers or exhausters and are obtainable in capacities up to 90,000 CFM.

Only Coppus makes both these types, one of which will give you better, more economical mine ventilation . . . know them by the "Blue Ribbon" that symbolizes the engineering and production skill behind every Coppus product.

Representatives listed in METAL and NON-METALLIC MINING CATALOGS. Other Coppus "Blue Ribbon" products: steam turbines, gas burners, heat killers, air filters, blowers and exhausters for special purposes. See also THOMAS' REGISTER...Coppus Engineering Corporation, Worcester 2, Massachusetts.

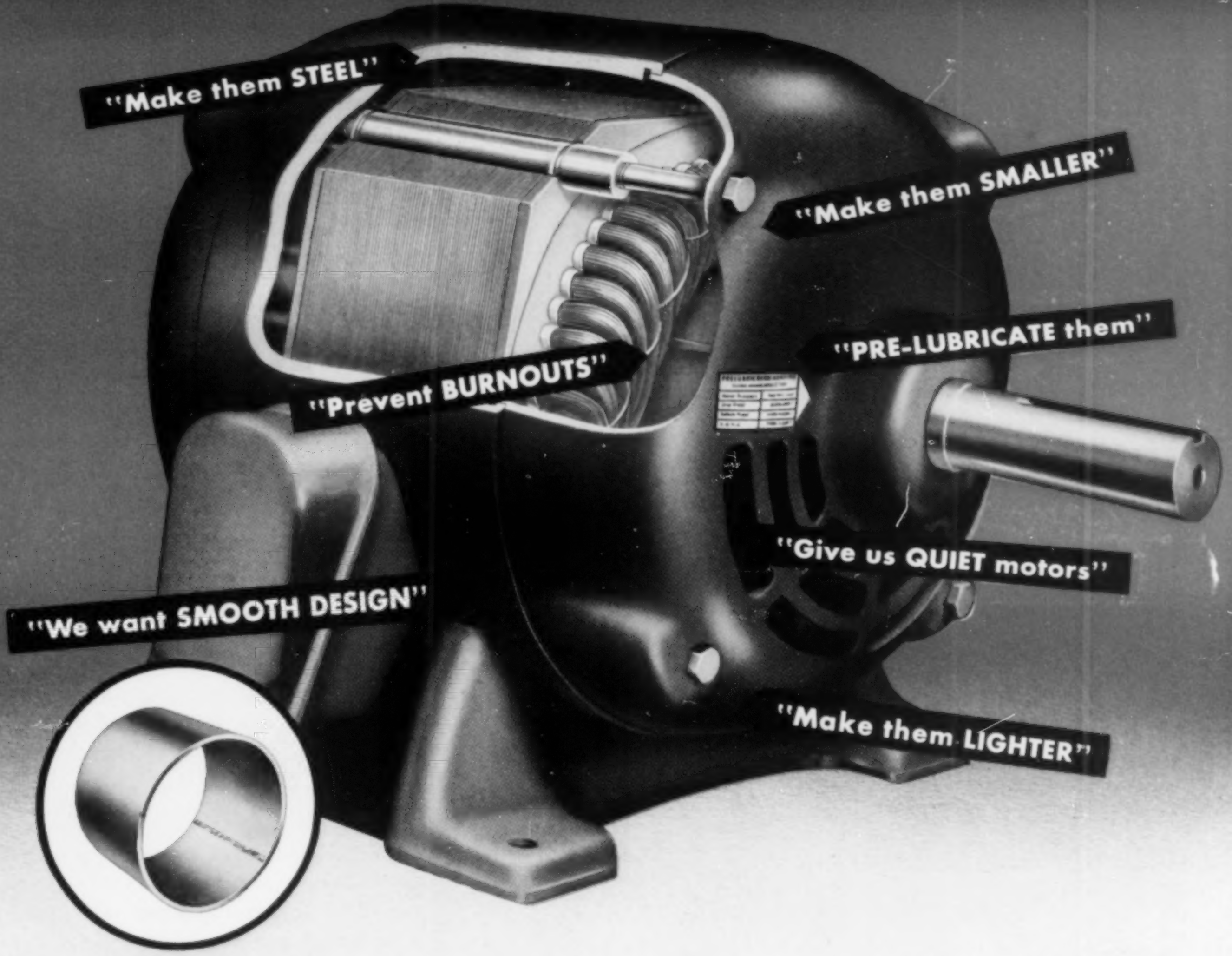
COPPUS ENGINEERING CORPORATION
212 Park Avenue, Worcester 2, Mass.

Please send......Bulletin 130

Name...

Company...

Address...



The seven improvements asked for most in motors . . .

wrapped up and *PACKED IN STEEL!*

For years, motor users complained that no one motor had all the features they wanted most.

Westinghouse engineers surveyed motor users to find out exactly what they needed . . . and then tailored an entirely new motor to fit those requirements.

The result is the new, outstanding Life-Line Motor—the first truly all-steel motor made available to industry. Packed in its thick, protective steel housing are more benefits asked for by motor users than any other motor made today:

ALL-STEEL PROTECTION. All frames, feet and brackets are HEAVY STEEL.

UP TO 35% LESS SPACE PER HP. Life-Line Motors occupy less space per horsepower than any other standard motor.

UP TO 134% MORE TORQUE PER LB. As much as 134% higher starting torque per pound of motor . . . up to 116% higher maximum torque.

NO LUBRICATION NEEDED FOR 5 YEARS. Bearings are prelubricated . . . sealed against dirt and moisture.

STRONGER ELECTRICALLY. New insulating materials . . . new coil-winding techniques . . . new stator slot designs . . . give new record-setting electrical strength.

NEW, QUIET SMOOTHNESS. Life-Line Motors cut vibration and noise to new low limits for standard motors . . . satisfy many "special motor" requirements.

NEW, SLEEK LINES. Sleek lines and smooth finish discourage dust and dirt accumulations . . . harmonize with modern machine design.

Write for details. Westinghouse Electric Corporation, P. O. Box 2025, Buffalo 5, New York. J-21422

Westinghouse
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Life-Line motors

NEW

New developments aid the miner and increase mine production.

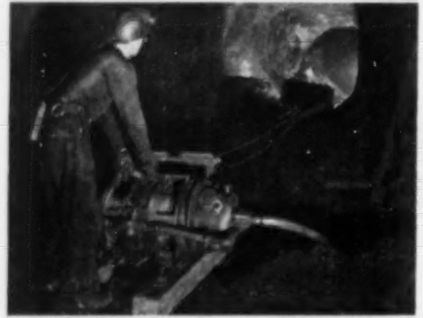
Mining equipment that is easier to operate, more dependable and more efficient helps the miner, the mine owner, and the users of the mine's product.

Ingersoll-Rand has been a leader in the production of labor-aiding mining machinery for over 75 years. Today new I-R developments are making mining more attractive to miners all over the world.

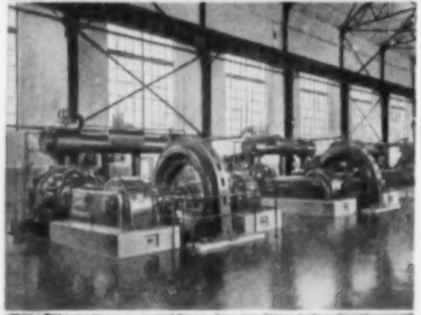
Ask an I-R engineer to discuss the new products with you.

ROCK DRILLS
A complete line of Jackhamers, Drifters, Stopers, Wagon Drills and Accessories for all mining and quarrying operations—featuring the "Featherweight" J-10 Utility Jackhamer.

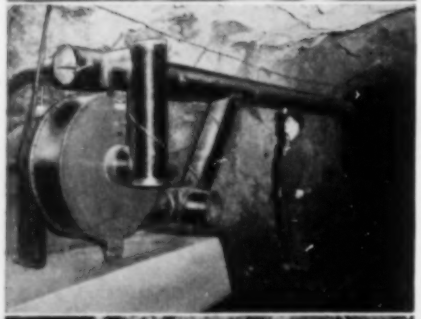
JACKBITS
A complete range of Jackbits and Jackbit reconditioning equipment—featuring the Jackstud attachment and the Carset Bit, mining's newest record-breaking team.



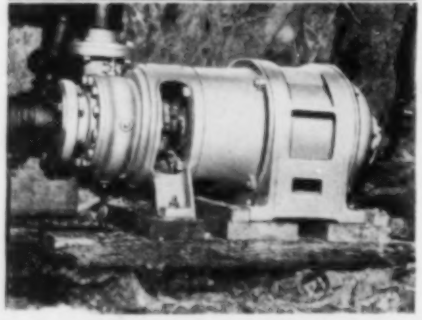
SLUSHER HOISTS
Air and electric slusher hoists increase the efficiency of underground loading and hauling—featuring "Unit-Assembly" construction.



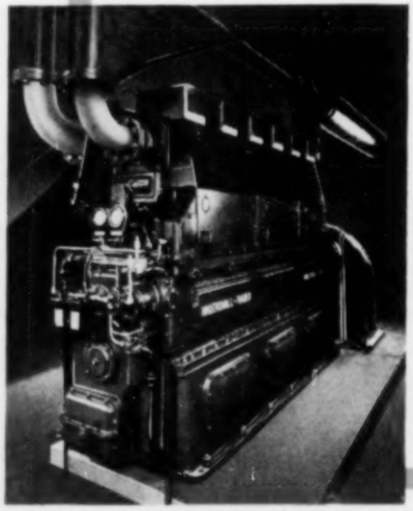
AIR COMPRESSORS
An air compressor for every need—featuring new standards in flexibility of type, design, drive, size and performance.



BLOWERS
Units to supply air for ventilation, smelting, flotation, converters, etc. —featuring new sizes and types.



PUMPS
Centrifugal pumps for every mine use—sump, station, shaft, water supply, boiler-feed, etc. —featuring new application and models.



DIESEL ENGINES
Efficient, dependable units for mine power up to 900 hp.—featuring compactness, ease of installation and air or pack transportation to remote locations.

IR

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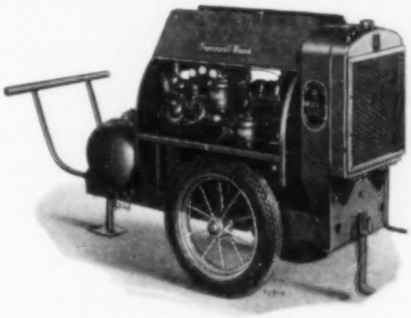
AIR TOOLS •

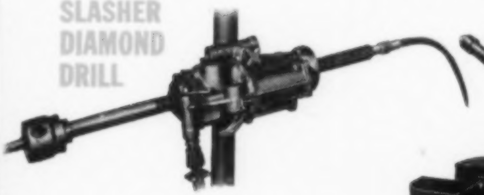
PRODUCTS THAT ARE MAKING THE MINER'S JOB EASIER

STUD JACKBITS
—Easier rod servicing, easier detachability, adaptable to alloy drill rods, lighter drills

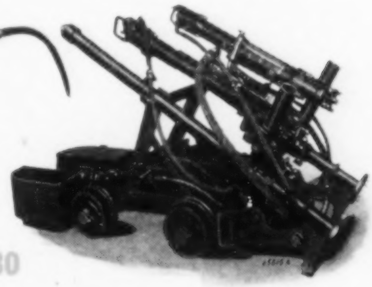


PORTABLE AIR COMPRESSORS
—30 to 500 cu. ft. per min.

JACKHAMERS
—Lighter weight, faster drilling, easy to hold (the J-10 Utility)

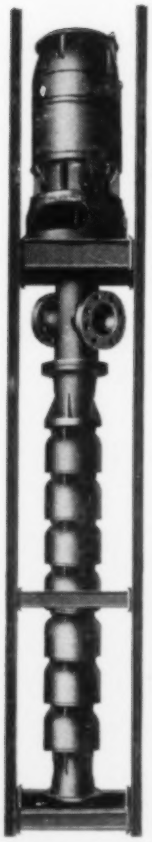


SLASHER DIAMOND DRILL

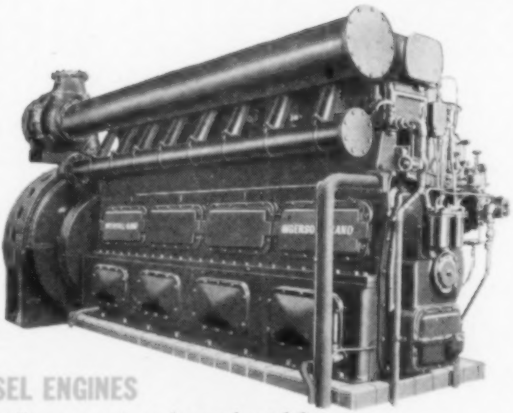


DRILL JUMBO

WAGON DRILL—New sizes



VERTICAL SHAFT-SINKING PUMPS



DIESEL ENGINES
including new supercharged models

THE JACKLITE
—Portable air-driven generator; 150 watts, 7½ lbs.

ROCK DRILL ACCESSORIES
—new—easy to use

Ingersoll-Rand

11 Broadway, New York 4, N. Y.

COMPRESSORS · ROCK DRILLS · OIL AND GAS ENGINES · CENTRIFUGAL PUMPS · TURBO BLOWERS · CONDENSERS

INDUSTRIAL CLUTCH
CORPORATION
1930
1936

CLUTCH PROBLEMS SOLVED HERE!

Through this entrance come many and diverse inquiries for clutches to meet special operating conditions.

Our engineering staff devotes its entire time to designing and perfecting clutches for jobs where stock clutches are not applicable.

At present we are in production on clutches designed to meet the particular requirements of air compressors, power shovels, railroad car lighting generators, machine tools, power presses and brakes, starting engines, and other equipment.

The Industrial Clutch plant is equipped with modern precision machines for producing special type clutches in any quantity required, small or large.

We welcome inquiries concerning your clutch problems and are in a position to give prompt service and deliveries on clutches designed to meet your requirements.

INDUSTRIAL CLUTCH CORPORATION

Waukesha Wisconsin

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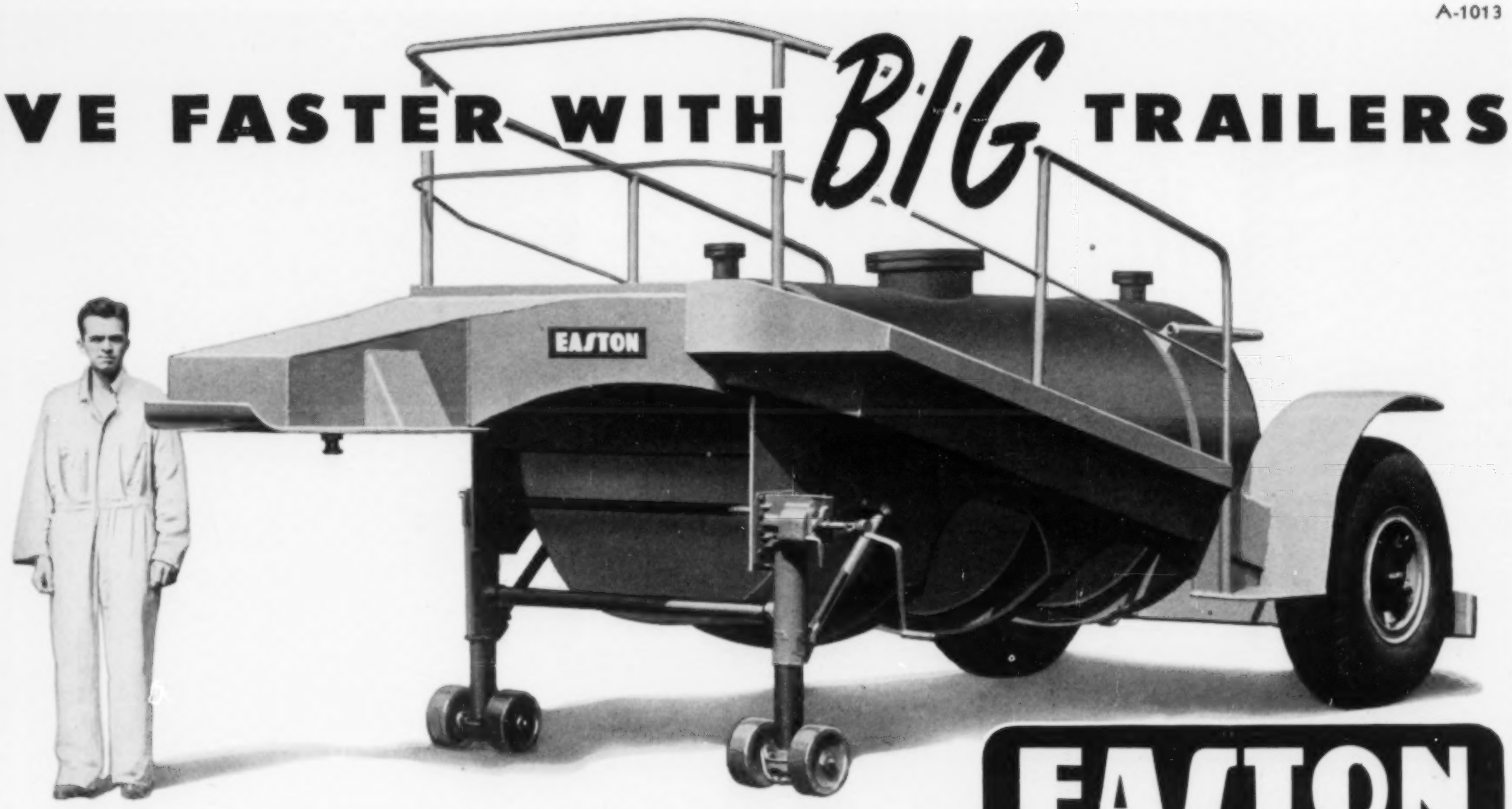
MOVE FASTER WITH *BIG* TRAILERS



EASTON
Trailers

AGAIN, the trailer idea has saved time, trouble and expense in an off-highway application. One of a trailerized fleet, this portable twelve-hundred gallon storage tank moves chemicals to distributing points within the plant area of a large manufacturing company. Storage tanks of capacities up to six thousand gallons, and larger, can be trailerized for fast, low-cost distribution of such materials as oils, paints, chemicals and gasoline, and for chemical fire-fighting apparatus in industrial service.

Big EASTON trailers have brought the advantages of speed, great capacity, flexibility and low operating cost to many fields of off-highway transportation. New applications for big, off-highway trailers will be envisioned by men of foresight in industry. Easton will design and build these trailers.

Easton Car & Construction Company, Easton, Pa.

ALL TYPES OF HEAVY-DUTY INDUSTRIAL CARS • TRAILERS • TRUCK BODIES • ELECTRIC TRUCKS

Here's How You Can Cut Costs On those Small Wheel Jobs...

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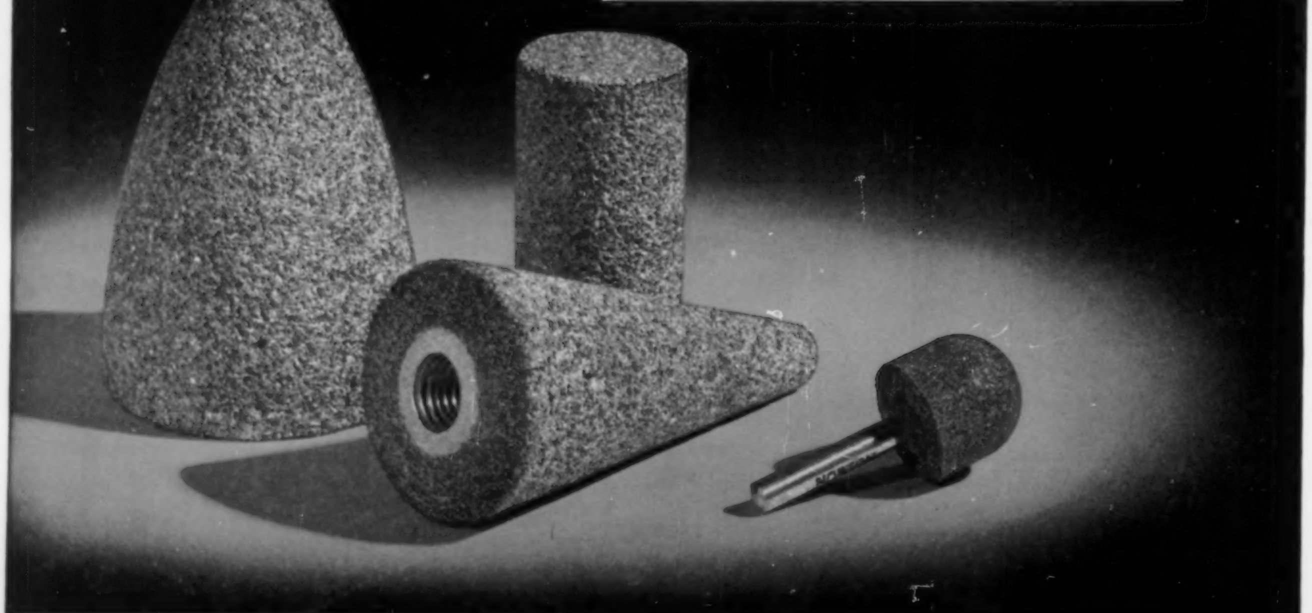

NORTON ABRASIVES

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Compressed Air Magazine

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ON THE COVER

ON HIS farm in the Muddy River Valley of southern Nevada, R. A. West has tractors, trucks, and other modern machinery, but for the water that gives life to his crops he still depends upon a device that dates back to the pre-Christian era. The 38-foot wheel lifts water 30 feet from the Muddy for distribution on his fields. Similar wheels, known as norias or Persian water wheels, are still common in some foreign lands but are rarely seen in the United States. The U.S Bureau of Reclamation is investigating a project to determine whether it will give the farmers of the valley a more stable supply of water for irrigation. The picture reproduced on the cover was taken by William S. Russell of the Bureau's photographic staff.

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COVERED-BRIDGE NOTES

CORRESPONDENCE arising from our October article on covered bridges reveals keen interest in these old structures. For example, the Indiana Historical Society has a covered timber bridge committee, of which Eugene R. Bock of Anderson, Ind., is chairman. Walter E. Robinson of Holyoke, Mass., who identifies himself as "Holyoke's covered bridge scout," informs us that he has just completed taking more than 400 photographs of New England covered highway and railroad bridges. He also cites two geographical errors in our account. The "Power's Folly" bridge mentioned on page 242 is, he states, at North Blenheim, as we reported, but in New York State instead of Connecticut, where we placed it. He also points out that Ithiel Town, originator of the Town "lattice truss," was not of Vermont, as we said, but a native of Thompson, Conn., who lived most of his life in New Haven, Conn.

●

FINLAND NEEDS TECHNICAL BOOKS

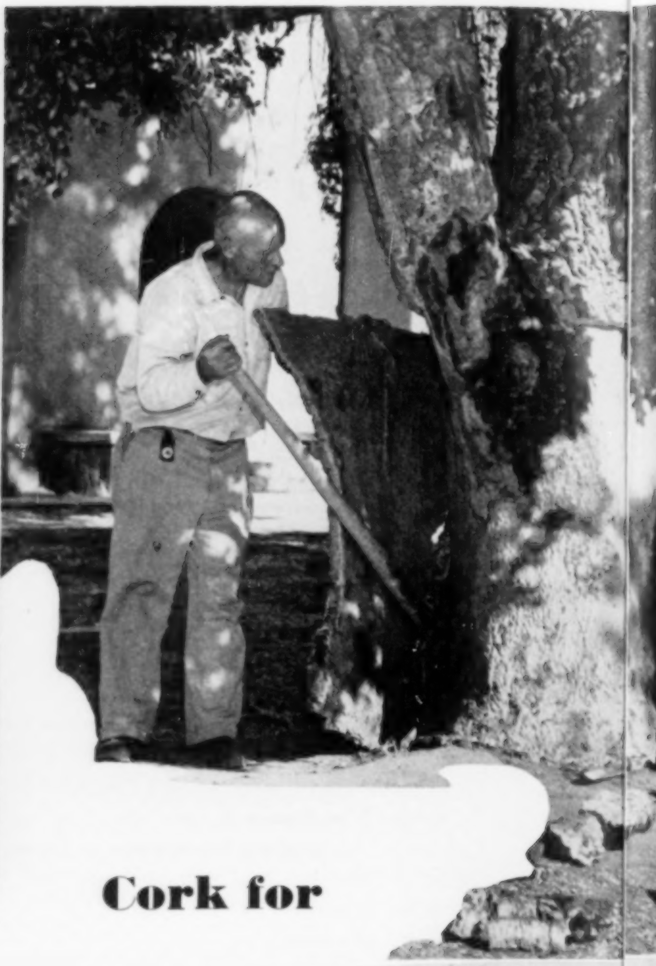
Editor:

Finland has an excellent and keenly scientific minded Technical Institute, Teknillinen Korkeakoulu. During the war its library was bombed and totally destroyed.

On my recent trip to Finland for the American Friends Service Committee, I discussed the situation with Dr. Martti Levon, Director of the Institute. He said he would welcome gifts of scientific and technical books and periodicals from America to take the place of those destroyed. In the remarkable efforts for recovery that the Finns are making, the lack of technical library facilities is a very serious handicap. It would be a practical act of friendship to a nation that holds America in high regard if Americans should contribute good technical books and periodicals to this library.

Any such gifts should be marked for the Institute of Technclogy, Helsinki, and sent to the Legation of Finland, 2144 Wyoming Ave., N. E., Washington, D. C. Dr. K. T. Jutila, the Finnish Minister, will arrange for their shipment to Finland.

Arthur E. Morgan
Member, American Friends Service
Committee, Yellow Springs, Ohio



Cork for

MATURE CORK OAKS

The largest cork oak in the United States (above) grows in Napa, Calif. It is 75 feet high and has a trunk diameter of 58 inches. The outer bark can be first stripped from the tree when it is about twenty years old, and about every eight or ten years thereafter. The tree shown being stripped (top-center) is at Merced, Calif. Governors of ten states have planted cork oaks on their respective state-capitol grounds. At the right, Gov. Ben Laney of Arkansas is pictured carrying out this ceremony at Little Rock.

A FEW years ago, cork, one of the commodities essential to this nation, was little known to the public. The average person was familiar with bottle stoppers and, possibly, knew of other cork articles, but they were accepted without much if any thought. Interest ended with their use. But the recent war made many of us conscious of some important materials which have received little consideration previously, and cork is one of them. Today, thousands are not only learning about its characteristics and applications, but also are planting cork trees. Why all this upsurge of interest in cork and effort to cultivate the tree? But before launching into this phase of the subject some facts about the tree and the materials it provides are pertinent.

Cork is the bark of the cork oak, *Quercus suber*, which is indigenous to the shores of the western Mediterranean. Nature has provided the tree with two proctective coatings: an outer bark, which is cork, and an inner bark. The cambium is inside the inner bark, and the cork can therefore be removed without injury to the tree. When the oak is about twenty years old, or 9 inches in diameter, cork is stripped from the trunk. The bark grows again, but much faster than it did at first, and thereafter stripping is repeated at from 8- to 10-year intervals. After boiling, cleaning, and drying, the cork is ready for the various manufacturing operations.

Cork has been used for various purposes for more than 2300 years and is now and has been for centuries a valuable article of commerce. Every day the material serves most of us either directly or indirectly in a great number of ways. The tree belongs to the oak family and, when mature, has a circumference of from 6 to 10 feet and is from 40 to 60 feet high. It grows well on a variety of soils, but thrives best where land has good drainage. It lives from 150 to 200 years, although individual trees have been known to survive for four centuries.

In addition to its valuable bark, the oak produces annually large acorns in generous quantities. This crop is used in Europe as supplemental feed for stock, and in Portugal alone hogs consume 200,000 tons every year. A bushel of these acorns (about 70 pounds) will make 6.5 pounds of pork. Being an evergreen, the oak also is an ornamental

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*Director, McManus Cork Project, Crown Cork & Seal Company

CORK-OAK CULTURE

Although most plantings in this country are made directly with acorns, in California it is the practice to grow seedlings and to replant them when they are a year old. The view below shows thousands of potted seedlings at Davis, Calif. A 4-year-old tree raised by the Texas Forest Service at College Station, Tex., is pictured at the left.

Our Future

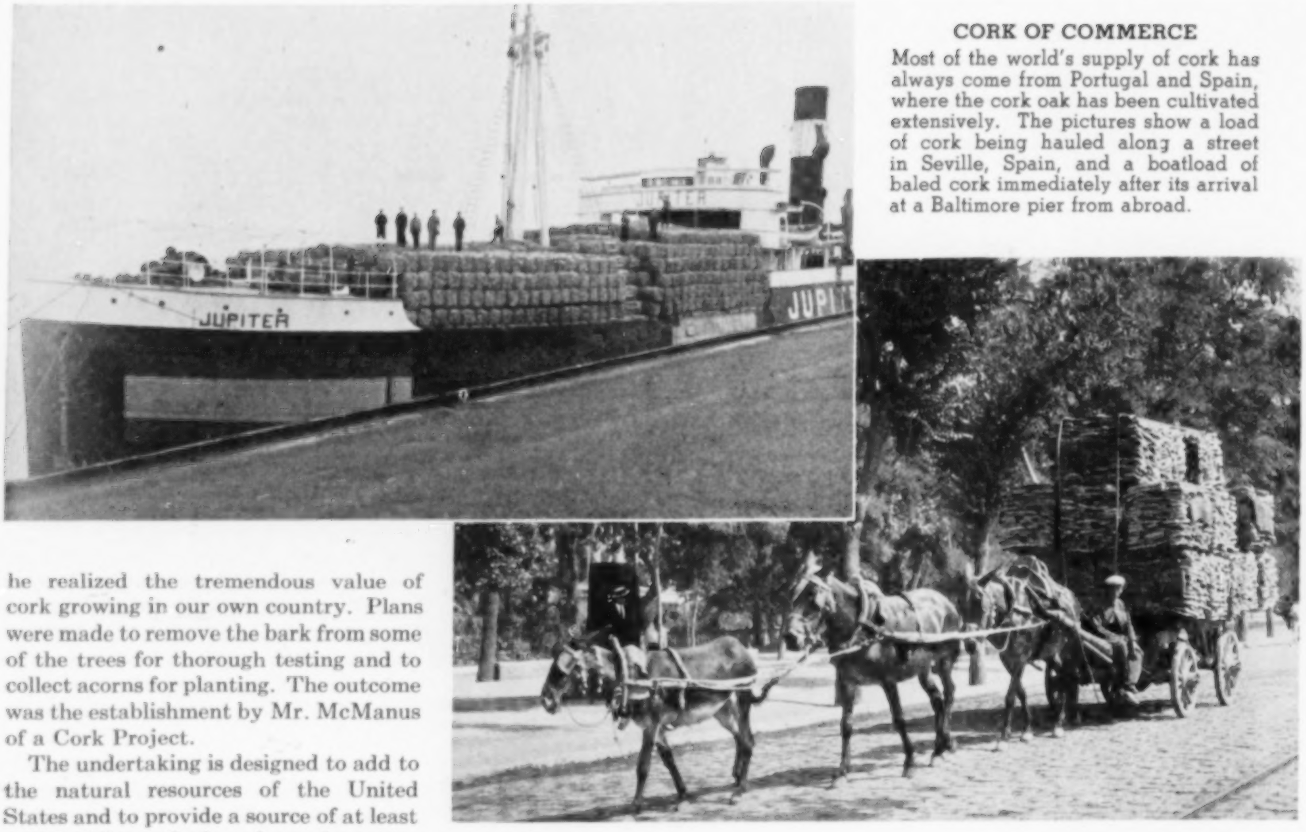
*Giles B. Cooke**

Trees Now Being Planted Will Add to Our Income and Security in Years to Come

shade tree. Under favorable conditions it will attain a size in four or five years that will add much to the appearance of a home. Public buildings, highways, and parks can be improved by plantings of the cork oak, for the heavy green foliage during the winter months is in delightful contrast to the bare branches of deciduous trees. Thus we see that this species of oak rewards its owner with much more than do many other trees.

There are in the southern, southwestern, and western parts of the United States a limited number of mature cork oaks. They were planted a few at a time during the past 100 years. They are ornamentals, but they have proved conclusively that the tree will thrive in many sections of this country. Some while ago, the late Charles E. McManus, former president and chairman of the board of the Crown Cork & Seal Company, examined some of these domestic oaks.

Having visited the cork forests of Europe and Africa on numerous occasions, Mr. McManus recognized at once the good quality of the cork. With more than 30 years of successful experience in manufacturing cork products,



CORK OF COMMERCE

Most of the world's supply of cork has always come from Portugal and Spain, where the cork oak has been cultivated extensively. The pictures show a load of cork being hauled along a street in Seville, Spain, and a boatload of baled cork immediately after its arrival at a Baltimore pier from abroad.

he realized the tremendous value of cork growing in our own country. Plans were made to remove the bark from some of the trees for thorough testing and to collect acorns for planting. The outcome was the establishment by Mr. McManus of a Cork Project.

The undertaking is designed to add to the natural resources of the United States and to provide a source of at least a part of the nation's cork requirements. The project, through the Crown Cork & Seal Company, carries on a continual search for mature cork oaks. It assumes the cost of gathering both acorns and raising seedlings for distribution throughout every state in the warmer half of the country where conditions are favorable. After they have been set out, the trees become the property of the planter. Every year, selected mature oaks are stripped, and the cork obtained is thoroughly tested. The formation of new cork bark, its rate of growth, and its quality are carefully watched.

The Cork Project has been received with tremendous interest and enthusiasm, and the U. S. Forest Service, state departments of forestry, forestry schools in universities, extension foresters, and local agricultural agents are coöperating. The success of the many important plantings and the splendid progress that has been made are due largely to the knowledge and skill of these men trained in tree culture.

Obviously, many problems arise and must be studied in a venture of this kind. One of the first was the storage of acorns. As the result of a series of experiments we now know that they can be kept viable for four months in moist cold storage at 34 to 40°F. Research is being conducted in the rooting of oak cuttings. Headway is being made in this matter, and in 1945 twelve seedlings so produced were planted in South Carolina. Cuttings are taken from trees that have thick cork of high quality and produce large annual acorn crops. Further, seedlings in individual containers are being given a plant-food test. The purpose of this is to determine how the oak responds to the various elements. When this is known, cork trees can be made to attain maximum growth. Other factors essential to their cultivation are under investigation.

The cork oak will thrive in most parts of the southern half of the United States. Vigorous mature trees are standing in Virginia and Florida, as well as in California from Humboldt to San Diego County. They grow well in Seattle, Wash., and Del Rio, Tex. Splendid specimens are also found in Arizona, Alabama, Louisiana, Georgia, and in the Carolinas. There are substantial annual plantings in these eleven states, and likewise in New Jersey, Maryland, Kentucky, Tennessee, Missouri, Oklahoma, Illinois, Indiana, Arkansas, Mississippi, and Oregon. Lesser experimental plantings are being tried elsewhere. All these are being closely watched throughout this immense area, and those sections in which the oak grows best are noted.

An exhaustive study of soil, rainfall, and temperature conditions has been made in the cork-producing countries as an aid to those engaged in the McManus Project. From these data has been prepared a map of the potential cork-growing areas in the United States. While this serves as a guide in the planting of trees, seedlings and acorns have been distributed to interested persons outside of the mapped zone, for it is entirely possible that the oak may thrive in sections of the country now considered unfavorable to its culture. It grows best in a mild climate—in a region where the mean annual temperature ranges from 50 to 70°F.

In the United States, mature trees are found in sandy loam, clay, and in gravelly, rocky, or rich garden soil. Plantings should be made in ground that has good drainage, and moderate watering during a prolonged dry period in summer is helpful. For fast growth, the ground may be enriched with fertilizer, cottonseed meal, or barnyard compost. However, authorities state that the best cork comes from oaks in poor soil. This condition causes slow growth and produces cork of fine, close texture.

More than 150 years ago, Thomas Jefferson stated that the cork oak would thrive in the warmer parts of our country and urged that the tree be planted. In 1787, while in France, he forwarded some acorns to William Drayton of "Magnolia" near Charleston, S. C. The package was three months in transit, and without doubt the acorns were nonviable when Drayton received them. Jefferson proceeded to send more, and until his death in 1826 he recommended the growing of the oak.

While no cork trees resulted from that effort, it did much good. In 1858 the Federal Government brought in acorns from Spain and distributed them in the southern states, as well as in California. Again, about 1880, more were imported and planted in the South and in Arizona and California. Those attempts were only partially successful, and many of the trees produced were lost. Failure to survive was attributed to storms, lack of care, and other causes. A few oaks grew to maturity, and some of them are magnificent specimens with large trunks covered with thick, resilient cork and with long spreading branches heavily foliated. About 4000 of them have been located in California, approximately 40 in Arizona, and from 60 to 70 in the southern states. During the past 60 years, some states as well as private individuals have tried limited plantings. It is from these domestic sources that the majority of the acorns for the McManus Project are obtained.

Most of today's plantings are with acorns. This is nature's method of reproducing cork trees and, given a fair chance, is highly successful. They are set in permanent locations to avoid the necessity of transplanting. In California, the acorns mature in November and December. They are collected promptly after falling and kept in wet, cold storage until distributed. Every spring, cork seedlings are grown in state-forest nurseries and, when one year old, are lifted and packaged with special care. They are planted as soon as possible in prepared ground.

Extensive plantings are made under like conditions in many states each year by Future Farmers of America and 4-H Club members. These young people are enthusiastic about the work and are obtaining splendid results. Acorns are given to the boys and girls by vocational agriculture teachers and county agents, and many small cork oaks are now flourishing in the South through their efforts. These high-school students will live to see their trees grow to maturity and to enjoy some of the benefits therefrom.

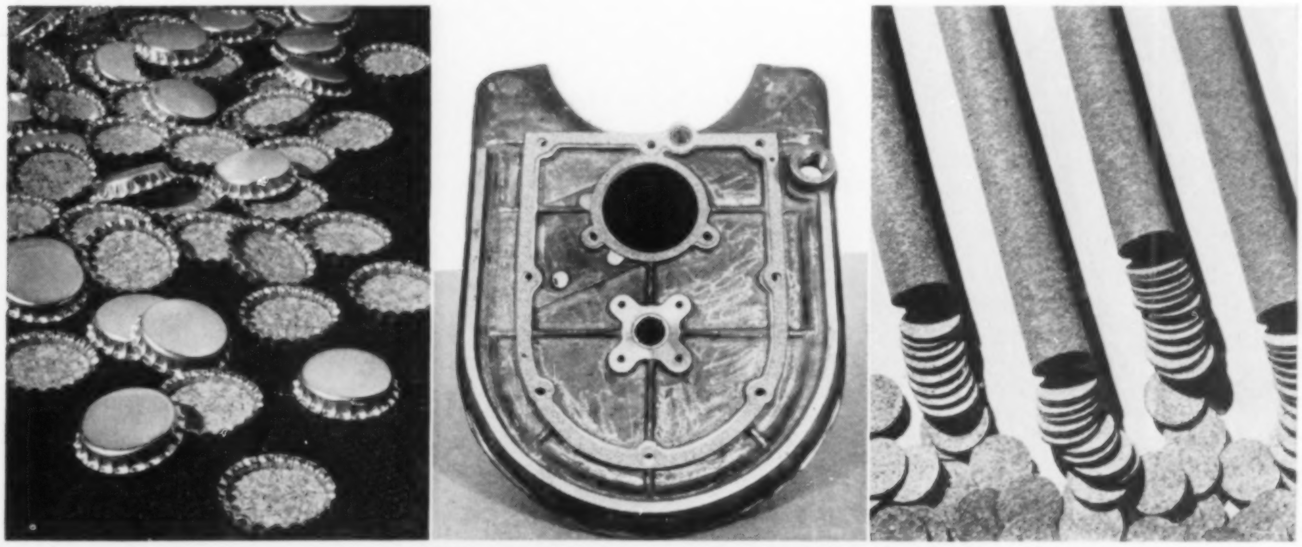
Some of the oaks planted in 1942 and 1943 have attained attractive size. Young trees from 8 to 10 feet high are scattered throughout the southern states, while those in the northern sections, where winters are cold and the growing season is shorter, are smaller—only from 4 to 6 feet tall. A few have reached unusual height, the fastest-growing cork oak reported being at Hastings, Fla. From an 8-inch seedling on June 1, 1942, this tree was more than 14 feet high and 4 inches in diameter five years later.

Through the coöperation of county agents and 4-H Club members in South Carolina, an oak was planted at each county seat in all the state's 46 counties under the direction of the Forestry Extension Service on December 6, 1946, when Arbor Day was observed. Various civic organizations, too, are lending their aid. Garden clubs are very active among these groups and have arranged cork plantings in many states. This past spring the Garden Club of Virginia set out a young tree at Monticello as a memorial to Thomas Jefferson who tried for 40 years to introduce the cork oak in the United States. One-acre groves are being established at a number of colleges and universities, and the governors of ten states have planted such trees on the grounds of their respective state capitols.

As with all materials, the uses of cork are determined by its physical and chemical properties. Cork has many important applications in its natural state, while composition cork and corkboard are in large demand. One of the oldest and best-known products of cork in the natural condition is the stopper, which has served for more than 2000 years to plug jugs, vases, and jars. It is also utilized as a sealing liner in bottle caps and other closures. Baseball centers, life jackets, ring buoys, floats, grips for penholders and tool handles, cigarette tips, and other specialties are made from that material.

Composition cork, which is produced by bonding together small pieces of cork with an adhesive, is used for such commercial articles as shoe inner soles, table mats, sealing liners for closures, and gaskets of many types for automobiles, trucks, tractors, electric motors, switch boxes, washing machines, gasoline meters, and hundreds of other things, as well as for friction rolls, printing-press blankets, polishing wheels, etc., etc.

Other important applications are found in the building industry. Cork tile is 100 percent cork, and linoleums contain varying amounts of it. More than one half of all the cork brought to this country is consumed in the manufacture of corkboard. Most of this serves as a low-temperature insulation, but some is installed for acoustical purposes. Cork is useful as a covering for cold-water pipes and in isolating machinery, while waste cork enters into the manufacture of firebrick and is a fine packing material. A recent patent covers the use of cork in bowling pins. Though by no means complete, the list is long enough to emphasize cork's commercial value.



CORK PRODUCTS

One of the earliest uses of cork was as soles for shoes. Nowdays it enters either by itself or in combination with other materials into hundreds of commercial articles. More than half the cork brought into the United States goes into corkboard that is utilized in various ways. Composition cork, made by bonding together small pieces of cork with an adhesive, forms the sealing liners for bottle caps (left). These wafers are cut from rods of the composition (right). Cork gaskets perform a similar service in many types of machinery. The part shown in the center has various cork sealing elements and is the cover of a beverage-bottling machine.

Forgings for Many Industries

Cornell
FORGE COMPANY

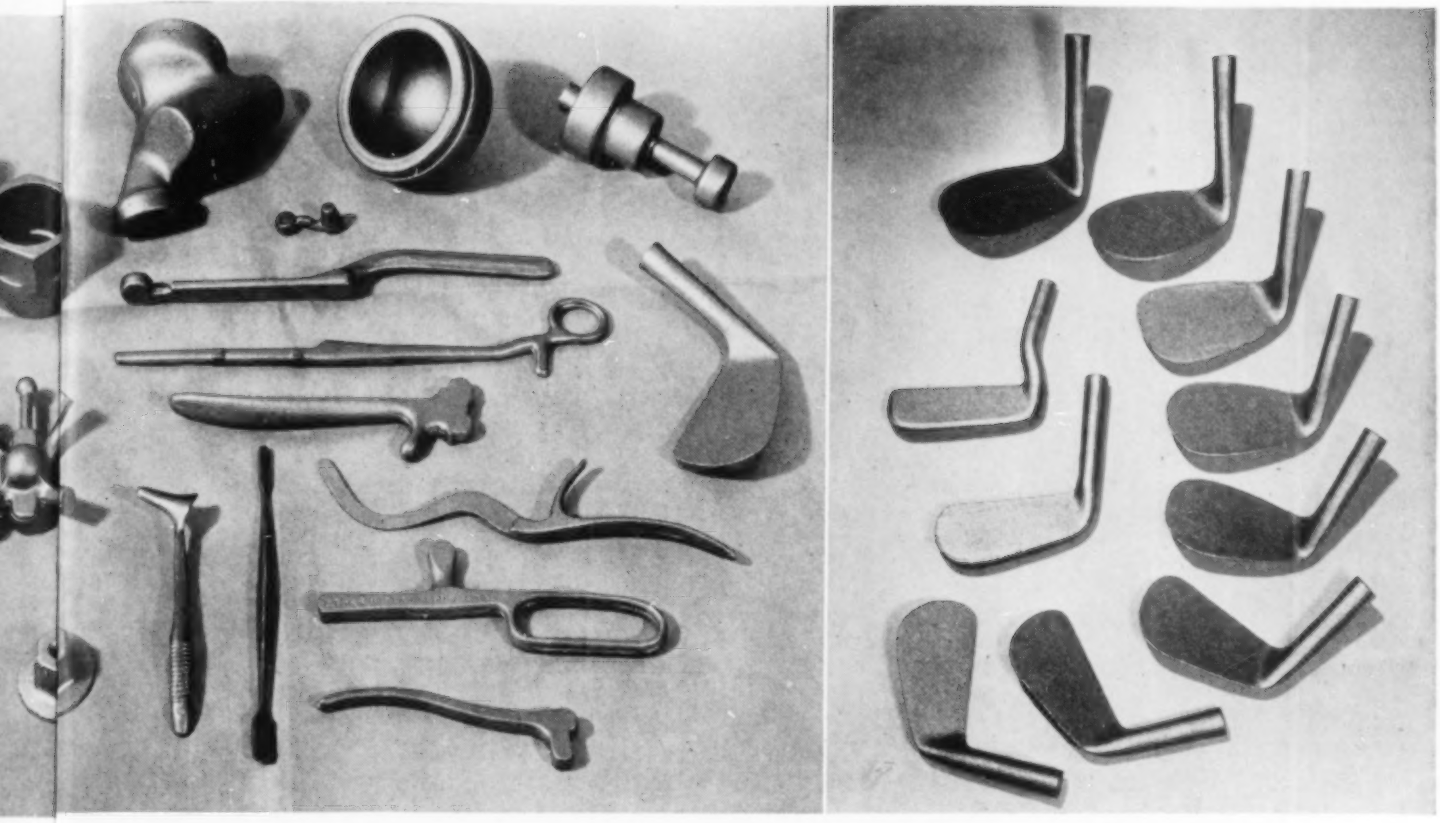
Myriads of Small Pieces Add Up to Big Business for the Cornell Forge Company

C. W. Gibbs

HOW are your iron shots? Have you ever thought that maybe the head of one of your clubs wasn't just right, or are you one of the less radical addicts who hold that success at golf is more logically a matter of personal knack and skill?

The Cornell Forge Company of Chicago, Ill., is doing its best to insure that nothing in the head itself will detract from your game—or should it be phrased, add to your score? Producing most of the drop-forged iron heads in the U.S.A., and numbering among its management and forging personnel many golf enthusiasts, the company insists upon high standards in quality and workmanship. Irons, of course, must be properly proportioned, accurate in weight, free from flaws, and smoothly finished, and the materials of which they are manufactured must be of the best.

All golfing irons are made to the designs and specifications of the companies that market them. Nine irons comprise a standard set and the head of each one is pitched at a definite angle to control the loft it will impart to a golf ball when



PLANT AND PRODUCTS

Forging metal is at best a grimy job, but there is no reflection of that fact in the exterior appearance of the Cornell Forge Company's plant (extreme left). The door mat at the entrance to the office building (left) is a harbinger of the spotless condition of its soundproof interior. Although the shop forges the heads for most of the golfing irons made in this country (some are shown above, right), about 85 percent of its total business is in other lines. Typical forgings are illustrated above, left. As many as 80,000 identical pieces have been made in single runs.

brought into proper impact with it. These clubs are made for both men and women, and for both right- and left-handed players of each sex. In each of these several divisions, clubs are offered in a choice of various models. The grips, shafts, and heads vary for each model and, in the case of the higher-priced sets, there is a choice of several different weights. Supplementing these standard irons are numerous more or less "special" clubs to satisfy the whims of those players who fancy they can use them to advantage for making certain types of shots. Since a separate set of forging dies is required to form each design of head, the investment in dies is obviously large. Cornell Forge Company has around 300 sets of them.

Manufacturers of golf clubs insist on close adherence to specified weights of parts and impose close tolerances on the forge shop. The heads, as forged, weigh about 12 ounces and must be within ¼ ounce, or about 2 percent plus or minus, of that weight. This is extremely close, considering die wear and other factors.

Most irons are made from high-grade carbon steel, but about 15 percent are of stainless steel. After forging there is a flash or excess material around the edges, which is trimmed off while the part is still hot. As the playing face may be somewhat distorted during this process, and as it is essential that the face be flat and the loft or angle with the shaft correct, most heads are restruck or coined when cold. Before this is done, however, the forgings are ground along the edges, heat-treated, and shot-blasted.

The final forge-shop operation is inspection, which involves checking each piece visually for cracks, pits, and surficial flaws. The heads that pass are then packed in burlap bags and shipped to golf-club manufacturers for finish grinding and polishing and mounting on the shafts. While golfing iron heads are a typical Cornell Forge Company product, they comprise only about 15 percent of its total output. In general, the firm specializes in small, intricate, high-quality forgings, varying in weight from 1 ounce to 15 pounds. Materials used include all grades of steel, various alloys, and occasionally monel metal, and parts produced are supplied principally to the dairy, sporting-goods, farm-implement, surgical-instrument, railroad, and automotive industries, and to others in lesser degree.

Cornell Forge Company was organized in 1930 by A. M. Cornell, an experienced forge-shop executive, and the initial equipment consisted of one board drop hammer, a trimmer, and a furnace. About a year later another hammer of the same type was added, together with the necessary auxiliaries, and since then the concern has grown until now there are ten hammers, each with trimming press, furnace, and low-pressure blower to furnish air for the furnace oil burner, for the air curtain in front of the furnace, and to blow scale from the dies.

From its inception, Mr. Cornell has been active in the management of the organization, although responsibility is now borne also by his two sons—Alverin M., vice-president, and Nelson, secretary—and by Howard Martinsen, production manager, and Lawrence Rowan, superintendent. In November, 1945, the company moved to its new location in the Clearing Industrial Association section of Chicago. The plant has about 115 employees at the present time and is a model of convenience, cleanliness, and working conditions. The office is soundproof, tastefully decorated, and well lighted. Radiant heating is installed in the floor. Rest rooms are modern in every respect, and for the women there is a small kitchen-dining room with electric range, refrigerator, and table so they can prepare their luncheon. Forging is a grimy job at best, so complete wash and change rooms, with showers and in-

COINING GOLF-CLUB HEADS

Immediately after a head is forged from hot metal, excess material around its edges is trimmed off. The edges are later ground smooth and the piece is heat-treated and shot-blasted. To correct any distortion that may occur during these operations, the head is restruck or coined in a hammer while cold.

dividual lockers, have been provided for the shopmen.

The machine shop and die-sinking room has windows on two sides, and between this wing and the next is a depressed loading ramp for trucks, permitting them to be backed up so that their decks will be at floor level. Underground fuel-oil storage tanks are in this area. Next is the inspection, die-storage, and shipping department.

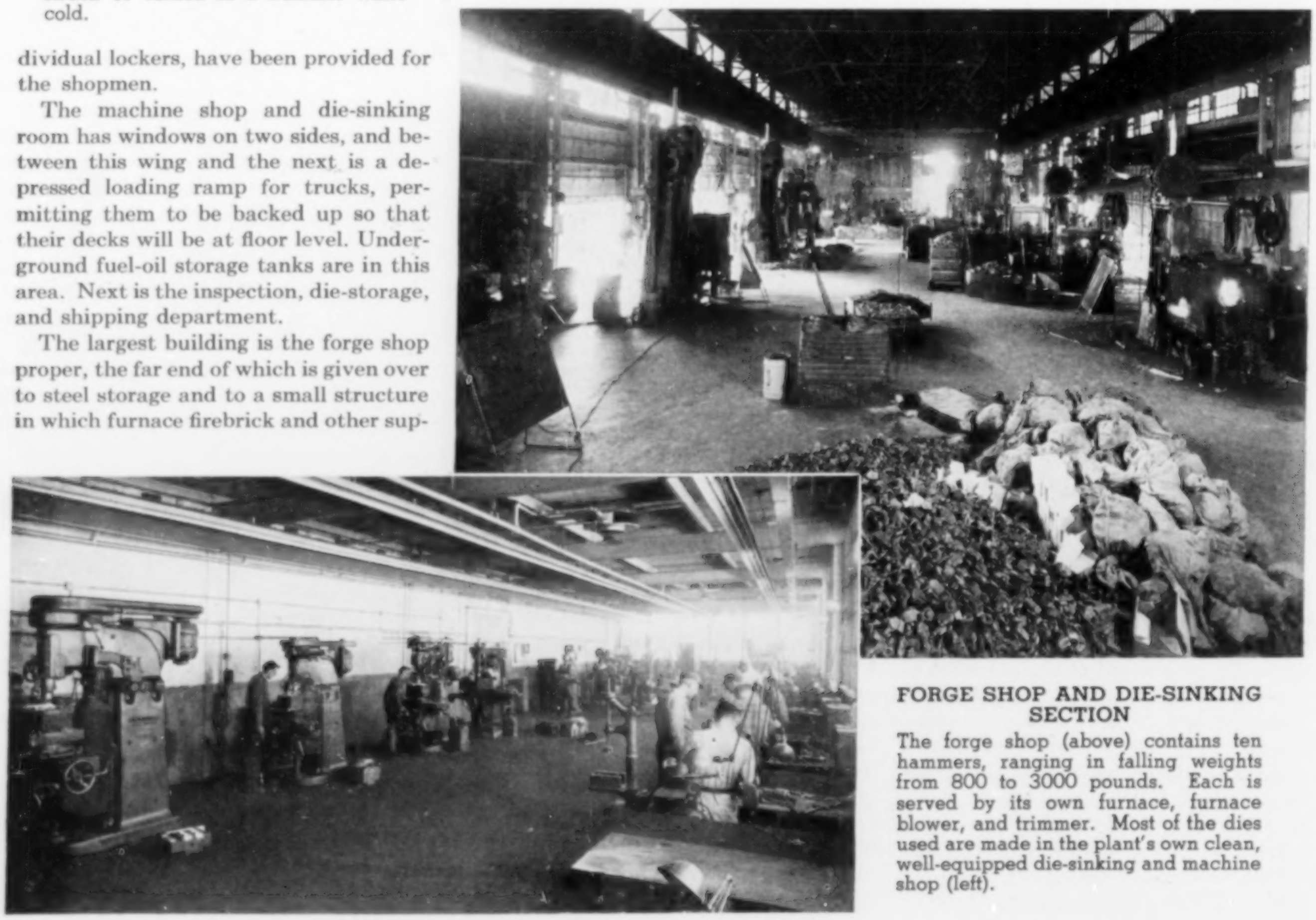
The largest building is the forge shop proper, the far end of which is given over to steel storage and to a small structure in which furnace firebrick and other supplies are housed. Steel and oil are received there in carload lots over a railroad spur, the former being unloaded in bundles and delivered to cut-off saws, if necessary, or direct to the furnaces by an overhead crane, which is also available for servicing machinery. Finished parts and scrap are put in skid boxes that are handled either by the crane or by hand or electric lift trucks. Basic plant power is electricity. Steam is generated in an oil-fired boiler only for space heating during the cold months and for preheating fuel oil.

Until September, 1947, all hammers were of the board drop type, some driven from side shafting by belts and others by individual motor built into the upper works. At that time the units consisted of one 3000-, one 2500-, three 2000-, three 1500-, one 1200-, and one 800-pounder. As mentioned before, each is equipped with its own trimmer, furnace, and furnace blower. All the hammers and trimmers were made by Chambersburg Engineering Company, which has recently celebrated its fiftieth anniversary in the forging-hammer business.

The management of Cornell Forge Company, with its insistence on high standards, is always looking for better methods and machinery, and in September, last, installed a Ceco-Drop hammer in place of the 2500-pound board drop unit. Known as the "boardless" board drop hammer it is the newest forge hammer brought out by the Chambersburg Engineering Company. It operates on the gravity-fall principle, as do all board drop hammers, but is lifted by means of compressed air rather than the friction of motor-driven rolls on maple boards inserted in the impact head or ram.

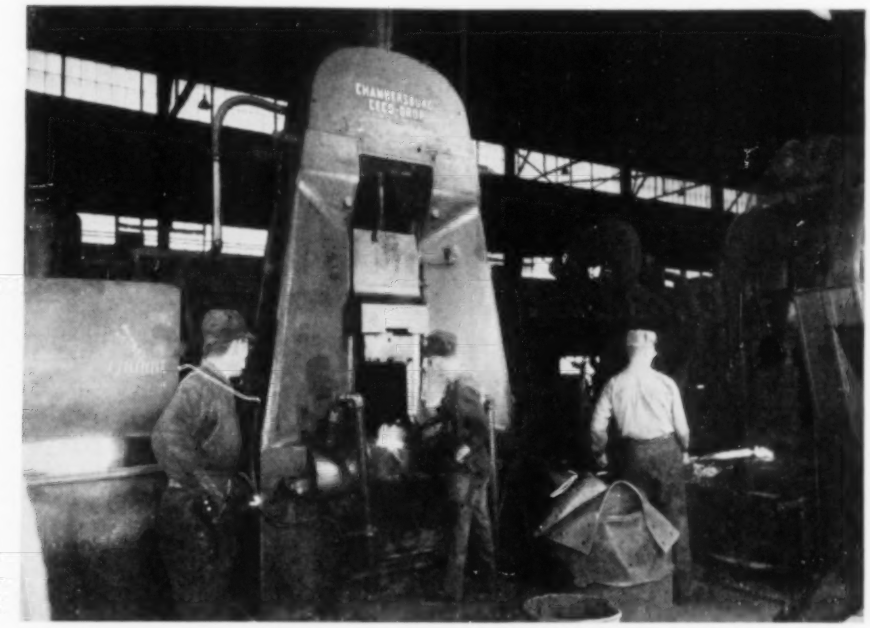
For the benefit of the uninitiated, board drop hammers have been used for certain classes of forging for a great many years, and while the basic method of operation has remained the same, many improvements in details have been made. Maple boards are held in the ram by wedges and extend upward through the upper works between two rolls. The latter are rotated continually either by a motor mounted on top of the hammer or by belt drive from a line shaft at the side.

In the accompanying general plant view there are several belt-driven units on the right and some motor-driven hammers on the left The ram is lifted to introduce hot metal into the dies by operating linkage through the medium of a foot treadle. This brings the moving rolls in contact with the maple boards with sufficient pressure to lift the boards and the ram. When the latter has reached a predetermined height, the pressure of the rolls on the boards is released and the ram and boards fall free. This process is automatically repeated



FORGE SHOP AND DIE-SINKING SECTION

The forge shop (above) contains ten hammers, ranging in falling weights from 800 to 3000 pounds. Each is served by its own furnace, furnace blower, and trimmer. Most of the dies used are made in the plant's own clean, well-equipped die-sinking and machine shop (left).



NEW AIR-OPERATED HAMMER

The latest development of the Chambersburg Engineering Company, this "Ceco-Drop," known as the "boardless" board drop hammer, was put in service in the Cornell shop in September of this year. The 2500-pound hammer element is raised by compressed air and falls by gravity. The hammer operates faster than one of the board type and without the frequent interruptions required in the case of the latter to renew worn or damaged boards.

so long as the operator depresses the treadle. When he releases it, the ram stops and latches hold it in the "up" position.

The Ceco-Drop produces the same results as the earlier machine but at a faster rate and with greater ease, because all the controls are air actuated and there is no heavy linkage to be moved by the hammerman. Much maintenance also is eliminated because the boards, even though of high quality, wear rapidly and adjustments must be made several times a day. Their life is relatively short, depending upon the size of the hammer and the work being done.

Because the boards may have to be replaced in anywhere from 30 to 70 operating hours, actual material and labor required may involve considerable expense, but most serious of all is lost production. Because of its simple air piston and pilot control, the Ceco-Drop is an extremely efficient machine and increases production from 10 to 40 percent. The Chambersburg Engineering Company originally claimed only a 10 percent increase, but reports from a number of installations indicate that figure to be very conservative.

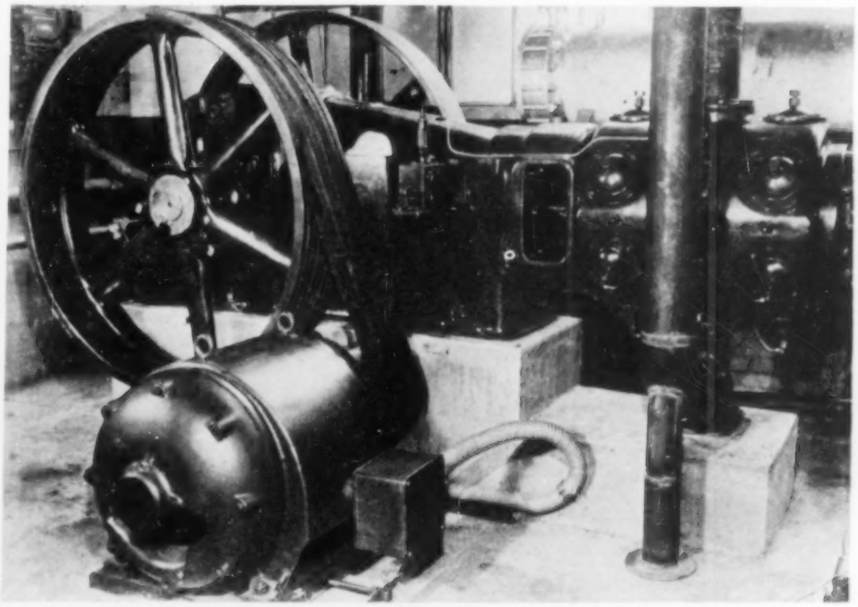
Using air power, the new Ceco-Drop is designed for operation from a standard shop system supplying air at 100 pounds pressure, maximum, at the compressors. The compressor installed at the Cornell Forge Company plant is considerably oversize for the 2500-pound Ceco-Drop, but it was the opinion that the extra capacity would be advisable in the event it was decided to put in another and smaller hammer. The compressor is an Ingersoll-Rand Class ES-1 horizontal, double-acting, heavy-duty, single-stage, single-cylinder unit with a 14-inch-diameter cylinder and a 13-inch stroke. It discharges directly into a Type PL pipe-line aftercooler and then into a 3½x10-foot vertical air receiver. Because the hammer is about 150 feet from the compressor, an additional 3x8-foot receiver is located near the former so that steady pressure may be maintained at that point.

The compressor is driven by a Louis Allis 100-hp., 1150-rpm., 104°F., drip-proof, squirrel-cage motor through standard V-belt drive. Automatic regulators of the free-air unloader type are operated by an auxiliary valve which loads and unloads the machine and thus keeps the pressure substantially constant even though the demand for air may vary from minute to minute. Intake air is cleaned by a filter before entering the compressor cylinder.

Compressed air is used in many places throughout the company's shop. As already mentioned, low-pressure air is required for the 1½- to 2-pound blowers which supply air for the furnaces and for all of the hammers, in the latter case for scale removal. In addition, high-pressure air blows away chips in the die shop as well as scale from a few of the forge hammers and serves to operate air clutches on the newer trimming presses. It is of interest to note that the air clutch is fast becoming standard equipment on various types of forging and trimming presses made by a number of manufacturers.

An unusual application of a pneumatic hammer, known as a paving breaker, is found in this shop. The tool is set in an adjustable tricycle-mounted frame and is used to drive the keys which hold the die in the ram as well as the corresponding bottom die in the sow block. The arrangement has eliminated much of the heavy sledge swinging formerly required of the workers.

The author expresses his thanks to the Cornell Forge Company for the assistance given him in the preparation of this article.



SOURCE OF AIR

This 100-hp., Ingersoll-Rand, single-stage compressor supplies air for operating the "Ceco-Drop" hammer and for miscellaneous shop purposes. It has sufficient capacity to power another small air-operated hammer.

Pneumatics Afloat

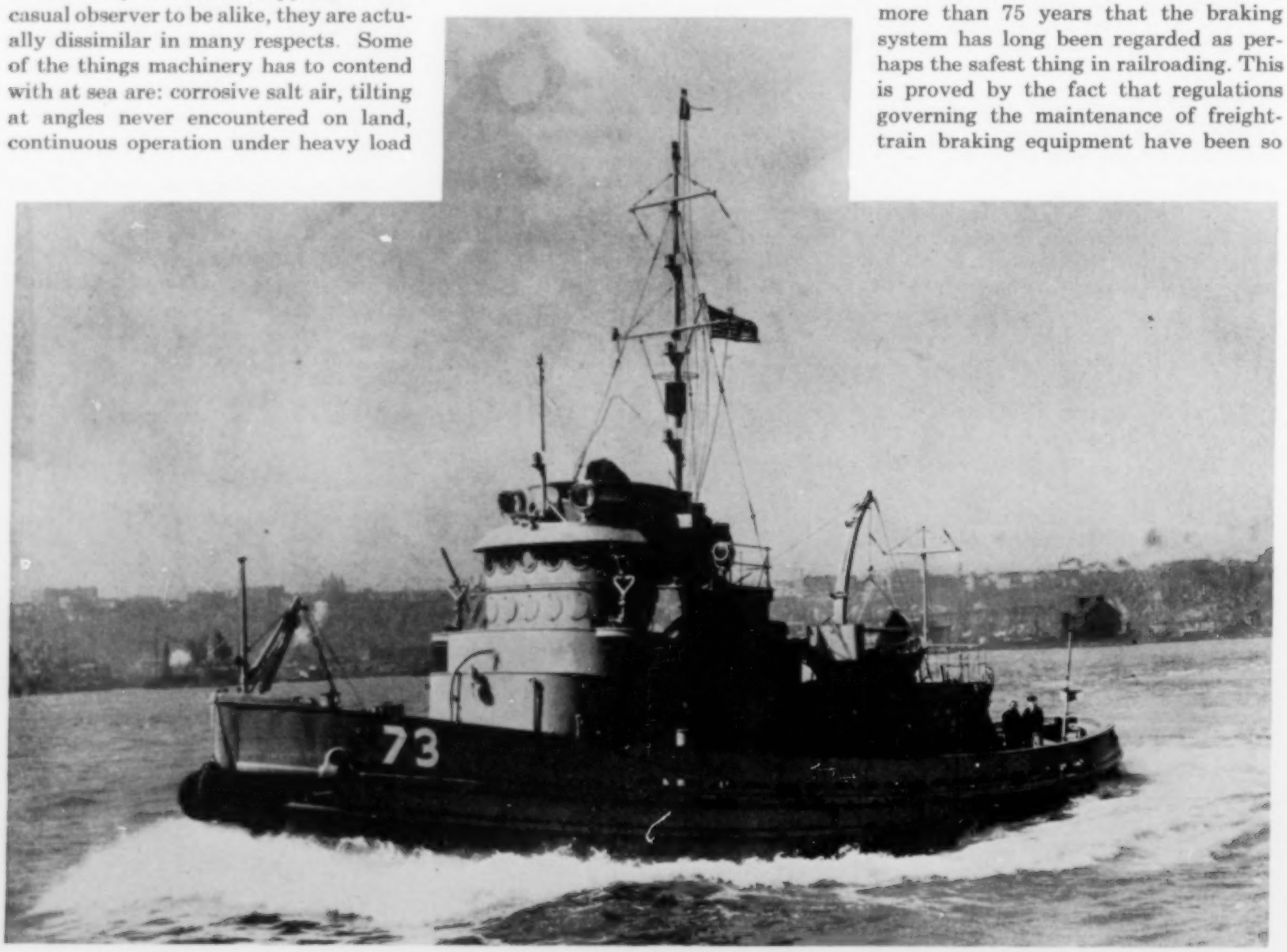
E. L. Holbrook

THE average "landlubber" is little acquainted with the part the marine industry plays in our national economy. The past few years have done more to focus general attention on its importance and achievements than any other period in our history. However, because of the peculiar emphasis placed on the vivid side of sea life, most of us are aware only of its romantic aspects and know little about the intricate and detailed movements necessary to each ship's voyage.

Rules governing the operation of seagoing mechanical equipment and the physical conditions under which it operates differ vastly from those applying to land-based machinery. Consequently, although machines for the two classes of service may oftentimes appear to the casual observer to be alike, they are actually dissimilar in many respects. Some of the things machinery has to contend with at sea are: corrosive salt air, tilting at angles never encountered on land, continuous operation under heavy load with little opportunity to coast or "breathe," proper timing, and speedy action to avoid dangers, etc. The actual operations called for in docking large vessels and in maneuvering tugs, fishing schooners, and combat ships differ from one another and vary for the same vessel with changing conditions of tides, wind, etc. The ability to handle ships in all the situations that may arise requires a technique that is not easily acquired. It is no easy matter to turn or stop a vessel in water because there are no rails to guide it or rubber tires to grip the surface. Maneuvering a ship therefore becomes an art, for this tremendous weight, if uncontrolled or loosely handled, would smash the best built piers to pieces.

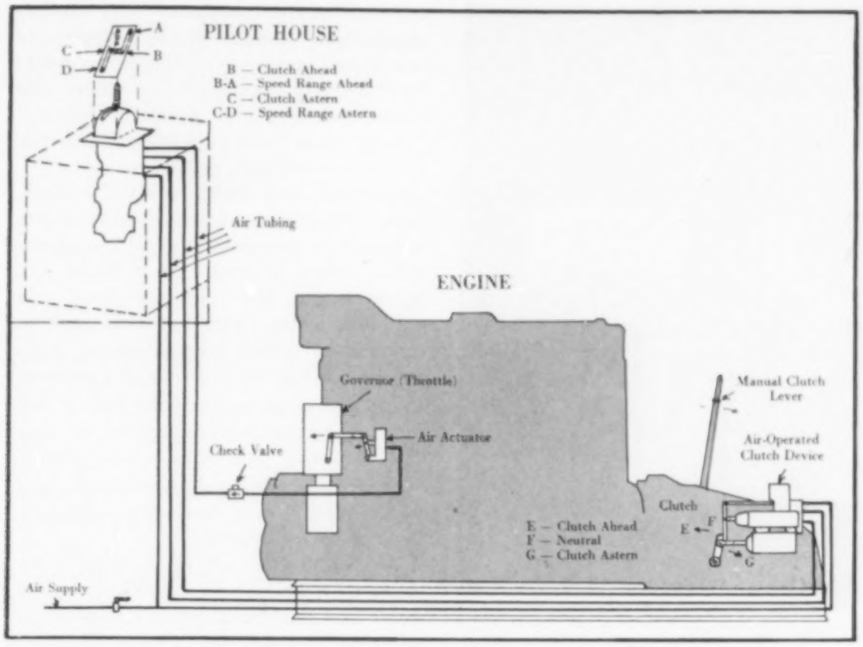
Obviously, the control of the engine maneuvers and steering action by which these craft are brought safely to berth is of prime importance, and it is desirable that it be accomplished as simply and effectively as possible. A slight delay in translating visual observations into actual ship or machinery motion can cause untold damage. Various methods of handling these varied control problems have been tried out through the years, but no wholly successful medium was found until compressed air was applied to the job. Other means were either not entirely suitable to salt-water service or were inherently cumbersome and unwieldy.

The first and foremost example of the use of air power in the control field was its application to braking railroad trains. It has served so well in this field for more than 75 years that the braking system has long been regarded as perhaps the safest thing in railroading. This is proved by the fact that regulations governing the maintenance of freight-train braking equipment have been so



COAST GUARD CUTTER "MOHICAN"

One of nine identical diesel-electric vessels built during the war. The propulsion motor receives energy from two generators, each driven by an Ingersoll-Rand 8-cylinder, 600-hp. diesel engine. By means of a pneumatic-control system the engines can be started, or stopped, or their speed can be varied from 280 to 720 rpm. in either ahead or astern direction of rotation. Speed controllers are located both on the bridge and in the engine room. The pneumatic system also actuates visible and audible alarms whenever the lubricating-oil or cooling-water system of the engine fails to function normally.



REMOTE CLUTCH AND SPEED CONTROL

Diagram of a pneumatic system for controlling an engine from the pilot house. At the latter station, a single lever, which moves as easily as an automobile gearshift, maneuvers the engine, as desired. It can be locked to maintain automatically any engine speed selected. Air lines are small copper tubes that can be run around obstructions and through small openings. The check valve in the line to the actuator has a choke that limits engine acceleration. The clutch-operating device, called pneudyne, unloads after the clutch engages.

relaxed as to permit 36 months to elapse between cleaning and inspection periods.

An emergency-brake action can today be transmitted throughout the entire length of a 150-car freight train at very nearly the speed of sound—and by purely pneumatic means! Actually, through the medium of 150 valves and their serial action, it races the 1½-mile distance at the incredible speed of 650 miles per hour. In addition to this speed it exhibits great flexibility, because each of the 150 valves is exactly alike and cars, therefore, can be placed anywhere in the train without regard to association, one with another. The pressure impulses received by one valve are so handled by that valve as to send them on with continued high speed to the next valve, and so on.

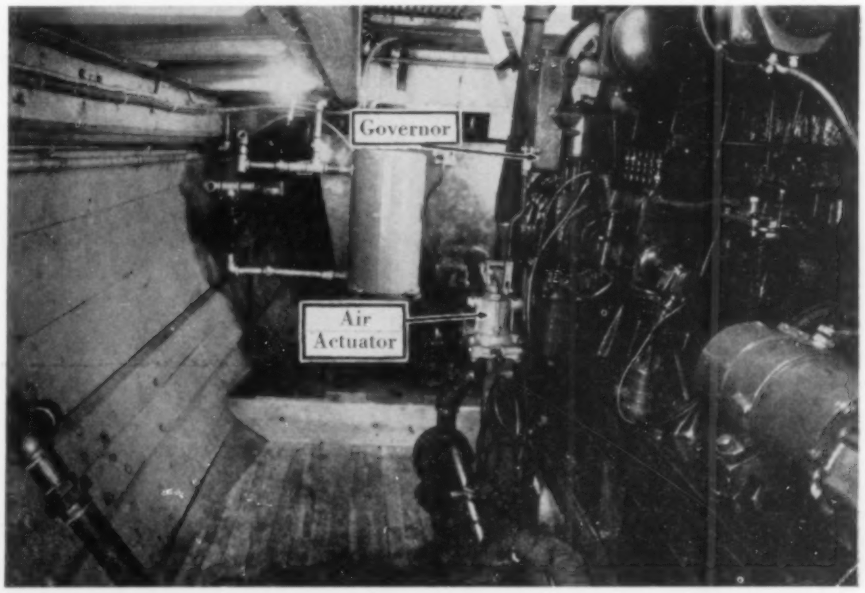
Following its initial success in railroading, pneumatic control was extended into other fields, and it has now been used for many years on cranes, derricks, some types of shop machinery, and elsewhere. It was comparatively easy to adapt it to the handling of numerous marine operations, for it had already demonstrated that it possessed the advantages of insuring sequential action, positive safety interlocks, coördination, and accurate timing of machinery movements, all combined in a reliably functioning medium.

The system is especially useful for remote-control-station operation because many functions can be incorporated in a simple, moderate-size operator's stand. Such a station can control the operations of propulsion engines, accessory machinery, and a variety of movements heretofore performed by "leg-work." It can also replace complicated systems of levers, chains, bell cranks, cables, etc., with easily operated small handles and air tubing readily bent to conform to the contours over which it runs. Obviously, pilot-house control on large or small vessels becomes easy of accomplishment and gives these craft real maneuverability. Duplicate stations on the bridge, at locations fore or aft, up the masthead, or in the engine room are readily added, as may be required.

To be sure, a few old sea dogs are still skeptical of this pilot-house control. They hold that nothing can take the place of engine-room hands. "What happens when it fails?" they ask. They have the feeling that engine-room help never fails and that men are much more reliable than machines. Probably nobody wishes the world to become too mechanized, but in the interest of safety of life and ships these things are to be considered: A control system doesn't fall asleep! It doesn't go out the night before! It doesn't get frightened in an emergency! And it cannot pull the wrong lever! Manpower can be better used to keep a close watch on the behavior of the machines and spot coming trouble rather than in pulling levers and waiting for signals from the bridge.

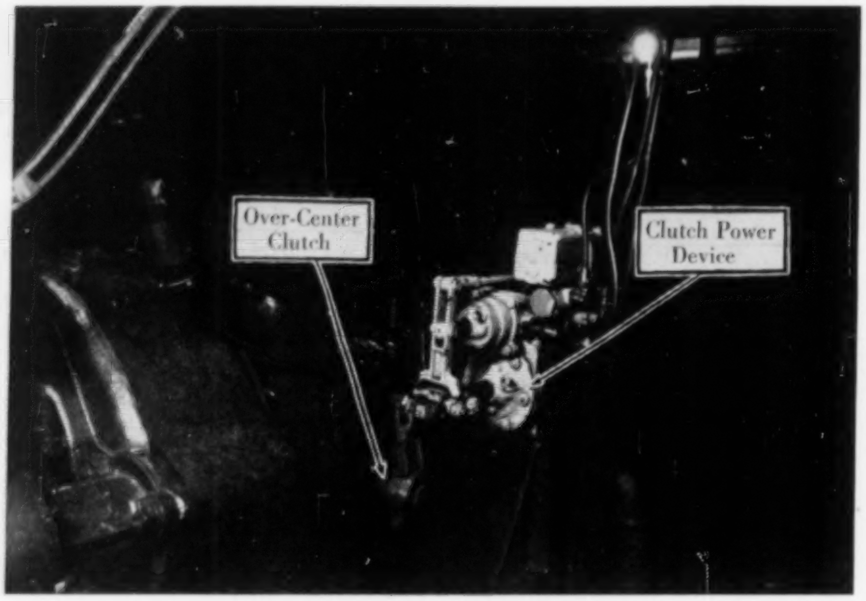
By incorporating safety features in them, pneumatic-control systems can be designed so as to give instant warning or to stop machinery whenever anything goes wrong that might cause damage. Interlocking elements also insure that first things come first.

During the recent war, there was an urgent need for large power plants to propel our swollen Navy and merchant-marine fleets. Diesel engines were the logical choice in a great many instances, important reasons being that American industry was geared to produce large



ENGINE-SPEED CONTROLLER

This air-operated device controls the speed of the engine by positioning the governor. The air actuator embodies a spring-loaded diaphragm. Increases in air pressure against the diaphragm are transmitted to the spring, which, in turn, positions the governor through a lever connection.



CLUTCH-OPERATING MECHANISM

Details of an air-cylinder assembly for throwing the overcenter clutch of a marine diesel engine into any one of three positions: ahead, neutral, or astern. The device is an air-servo mechanism in which the actual positioning is done by a pilot piston which, through a leverage system, admits compressed air to the power piston. The levers actuate properly designed valves. After the power piston has reached the full extent of its stroke the air is automatically released from the cylinder so as to remove any strain on the clutch plates.

numbers of them quickly, that they took up little room aboard ship, and that boiler plants and other accessory equipment did not have to be built and set up. Since a sufficient number of the larger diesel engines was not immediately available, it was only natural that engineers turned to coupling several medium- or small-size diesels together to obtain the necessary driving force for the larger ships. These engines, then, had to be handled as a unit, and this called for a control system possessing flexibility, precise action, and simplicity. All of these requirements were readily met by pneumatic methods. It is principally on diesel-engine-driven vessels, then, that pneumatic controls are found, although they have been applied in lesser degree on craft driven by other means.

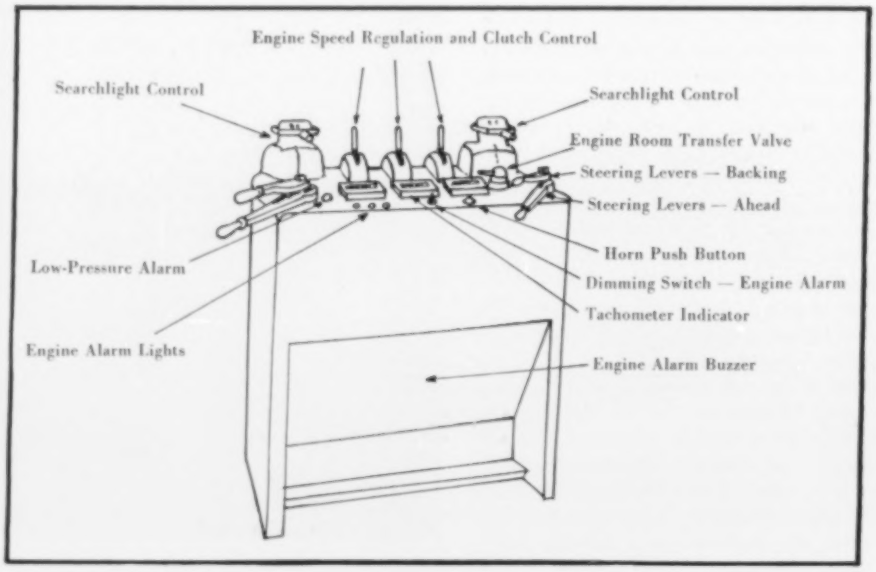
In the engine-control field there are two general types of marine diesels: direct-reversing and nonreversing. Controlling the speed of either is essentially the same. The nonreversing engines, in which the order of firing of the cylinders and the direction of crankshaft rotation always remain the same, are made maneuverable by means of a 2-directional-clutch, reversible-pitch propeller, or electric drive. In other words, ahead or astern movements are actuated by some means that might correspond to your automobile gear shift except that it is not so elaborate and has just one point ahead and one to the rear. In the control field, this merely requires some mechanism to position the clutch lever, reverse the propeller pitch, or change the electric-drive field-current direction.

On the reversing engines—which, when being reversed, have to be stopped and the direction of the crankshaft rotation changed—all functions center around the shifting of the camshaft, which is moved to set up the proper sequence of cylinder firing, fuel injection, and exhausting the burned fuel, depending upon the direction of crankshaft rotation required. In some cases, many of these operations are mechanically connected to the camshaft itself so that its motion nearly completes the requirements for a reversal. On such engines it is a simple matter to attach air cylinders to the engine maneuvering wheel and rotate it to a desired point for "start," "stop," and "run" positions in either the ahead or astern quadrants.

However, on a large number of engines, these and other associate operations are separate functions that must be coördinated in the control system itself. In other words, the various valves and cylinders of the control system must be interlocked within themselves so as to actuate several movements of a reversal in proper sequence so that fuel is cut off, the engine brake applied to stop the crankshaft, the valve cam is shifted, starting air is admitted for reversing, and fuel is turned on in that order, with perhaps slight variations.

Several engines are often coupled together to drive a single propeller, and the maximum number possible is limited by machinery space, etc., rather than by the pneumatic-control system. In cases where a bank of engines is so operated, there must, of necessity, be close synchronization of engine speeds, or equal distribution of loading, in order to obtain the maximum power-plant efficiency.

An example of synchronizing is that of two engines connected to a single shaft through a hydraulic or electric clutch and a reduction gear. Obviously, the engines can run at different speeds because the flexible clutches permit slippage. However, this would be poor engineering, and when two such engines are controlled by a single-handle control system, a vernier or variable adjustment is usually provided to permit the setting of one engine governor to conform to the speed set up by the other. Pneumatic controls are



CENTRAL MARINE CONTROL STAND

This is equipped for controlling all essential ship services merely by moving levers or pushing buttons. Visual and audible signals give warning of faulty or abnormal engine operating conditions.

the means whereby this function is performed.

Other features are also available for this and similar installations. Reduction-gear oil pressure can be interlocked with the clutch control and perhaps a propeller shaft brake so that reduced oil pressure or loss of oil will automatically disengage the clutch and apply the brake, thus preventing damage to the reduction gear. Clutch controls can be installed so that small control valves on the stand will permit cutting out either engine, as may be required by the engineer. Either audible or visible signals interlocked with control functions indicate the operation or warn the operator of abnormal conditions. The pilot-house control feature allows the captain and navigator to handle the boat in cases where instant maneuvering is required and relieves the engine-room personnel of much manual work.

In addition to complete control of all engines, either from the pilot house or engine room, or both, many other auxilliary controls may be added. If that is done in the engine room it reduces the amount of running around by the engineer to various pieces of equipment that usually require attention. In the pilot house, added features may be control of steering engines, searchlights, horn, etc. If it is a work boat, the control of clutches, brakes, and pawls of loading cranes can be placed on the bridge, on top of the pilot house, or in any number of strategic locations. In some instances, by the use of flexible hose connections, a control stand can be made movable, permitting the operator to locate himself at some advantageous point to speed up operations in docking or loading. It enables a pilot or craneman to keep an accurate check on his clearances without the necessity of shouted or hand-waved signals, neither of which is too effective.

For some types of commercial fishing, the pilot is stationed up the masthead in order to keep a sharp lookout for a school of fish. When fish are sighted, the boat is maneuvered by relayed shouting to the pilot house and then to the engine room. This can all be accomplished much faster by having a control stand located up the masthead for direct operation. Much valuable time is saved, the chances of losing the school of fish are minimized, and more boatloads of fish per season can be caught.

On smaller vessels having nonreversing engines with over-center clutches, a pneumatic-control system not only increases maneuverability with a minimum of effort by the pilot but the interlocking of speed and clutch controls also makes it impossible to throw the clutch without first reducing to idling speed. This safeguards the clutch against excessive wear, whereas with mechanical controls that are not interlocking an operator is apt to throw the clutch at full speed and depend upon its movements to do all the maneuvering. This subjects it to extremely heavy duty and inevitably shortens its service life. The pneumatic system has a single-handle control for both operations. Twin-engine controls permit handling both engines together or separately, as required.

These are only a few of the many things that have been accomplished by pneumatic controls in marine service. Other useful applications of air power aboard ships are: the use of low-pressure air instead of electric- or hand-operated pumps for lifting toilet water; the operation of heavy hold doors; the locking of watertight compartments; the lowering and raising of pilot houses of river boats; and the release of gangplank and lifeboat trips.

Actuating devices in ship pneumatic-control systems are of either the diaphragm or the cylinder-and-piston type. The former often operate at pressures as low as 60 psi., while the latter commonly require 100 psi., and sometimes 120 or higher. Compressors for this service ordinarily discharge at 150 or 200 psi. into a receiver from which the air supply is withdrawn as needed and passed through reducing valves to obtain the pressures desired in different parts of the system. Only small quantities of air are generally required, the heaviest consumer among

the devices being the air brakes that are sometimes applied to propeller shafts to facilitate quick stopping preparatory to reversing.

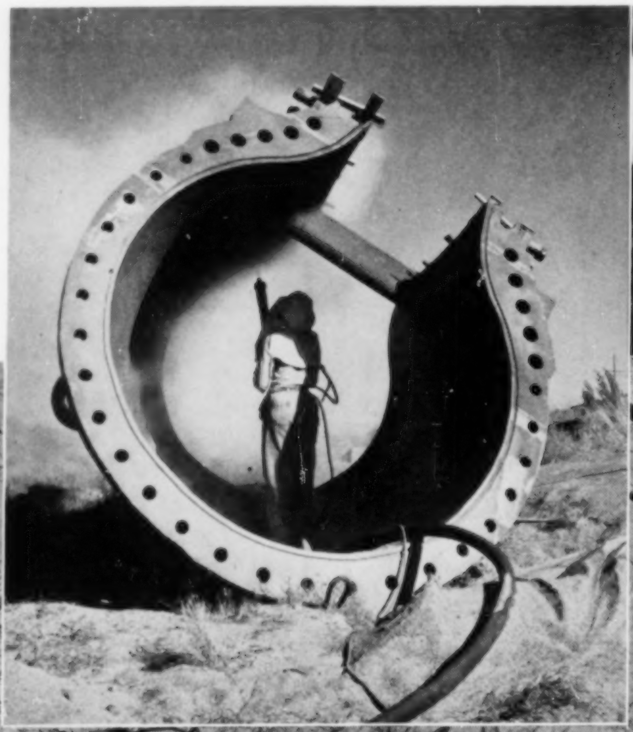
On small craft, such as tugs or fishing vessels, a 1½-hp. compressor will usually handle the load and provide a substantial surplus capacity. Two units of this size will oftentimes serve the control needs of a much larger ship. This was true during the war in the case of combat ships driven by four 1750-hp. diesel engines. Two compressors were specified instead of one machine having their combined capacity in order to minimize the chances of the air supply being interrupted by shell or bomb damage. Still larger vessels may have compressors up to 10 hp. for control purposes. Electric-driven, air-cooled units are almost always used. Where the discharge pressure is not more than 150 psi., single-stage machines are often utilized, but 2-stage machines are usually preferred because they permit discharging at 200 psi. pressure, with the consequent storage of more air in a receiver of a given size. In case of compressor damage or failure, this provides a larger reserve supply of air for use until repairs can be made.

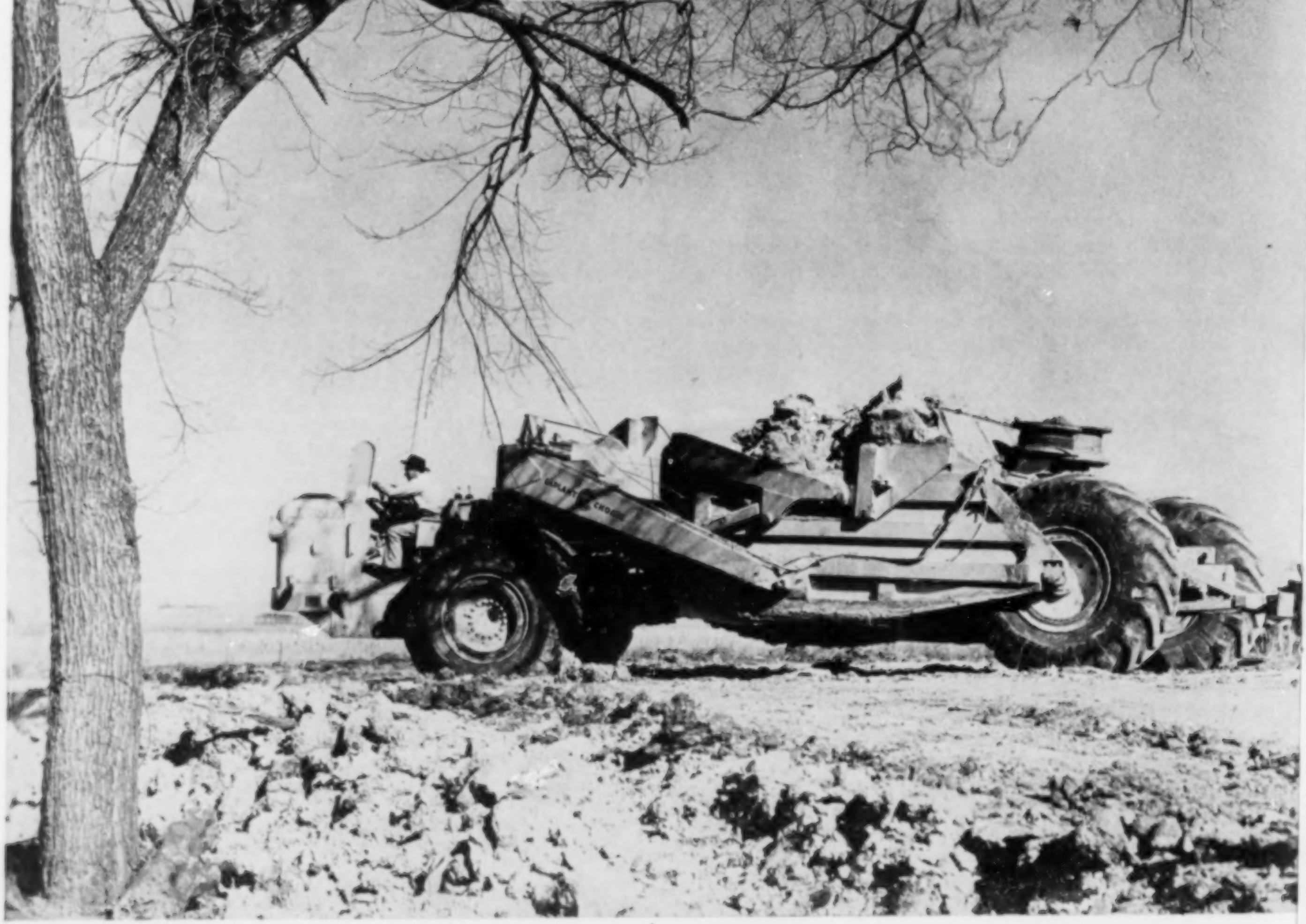
TUGBOAT WITH PNEUMATIC CONTROLS

Following the successful application of pneumatic controls on the Navy's YT boats during the war, equipment of the same type has been installed on several new tugboats, of which this is one. It is owned and operated by an electric-utility company of Norfolk, Va.

SHOWN at the right is a large section of the scroll case that will carry water to the turbine of generating unit No. 9 at Grand Coulee Dam in eastern Washington. The workman is sand-blasting the interior to remove a temporary coat of paint applied by the manufacturer. After being cleaned, the surface is covered with a rust-resisting coal-tar product. The Grand Coulee generators, rated at 108,000 kva. each, are the largest in service.

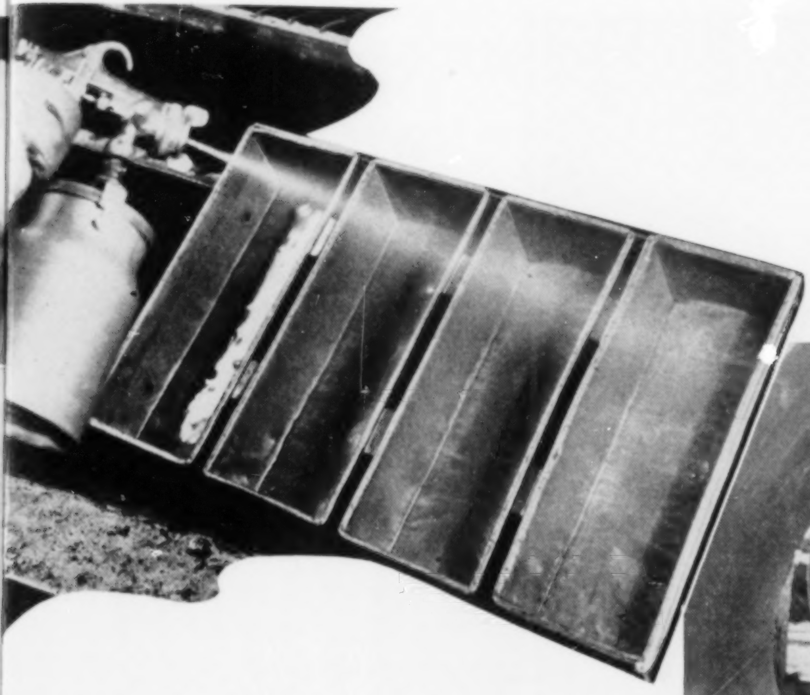
BUREAU OF RECLAMATION PHOTO





TYPICAL of the huge earth-movers now available for roadbuilding and general construction work is the La Plant-Choate "Moto-Scraper" pictured above. It scoops up a load of 17½ cubic yards of dirt and transports it at speeds up to 18 miles an hour. The cables that open and close the scraper bottom are air operated, as are also the 4-wheel brakes. Compressed air is supplied by a 7½-cfm. compressor driven by power take-off from the 225-hp. diesel propulsion engine. Three storage reservoirs insure an adequate volume of braking air at all times. The vehicle weighs 42,500 pounds, empty, and is equipped with 21.00x29-inch pneumatic tires. It is approximately 35 feet long, 11½ feet wide, and 10 feet high. The steering gear is actuated by two double-acting hydraulic jacks.

COMPRESSED AIR AT WORK



DEVELOPMENT of a new silicone glaze by Dow Corning Corporation, Midland, Mich., has made it virtually unnecessary to grease pans in bakeries. One application of the film suffices for an average of 200 bakings, after which it is renewed. The glaze is quickly and evenly sprayed on the pans with compressed air, as shown at the left. A gallon of it will coat from 1000 to 1500 bread pans. Besides saving labor, the use of the glaze eliminates greasy floors and uniforms, as well as smoke from burning grease.

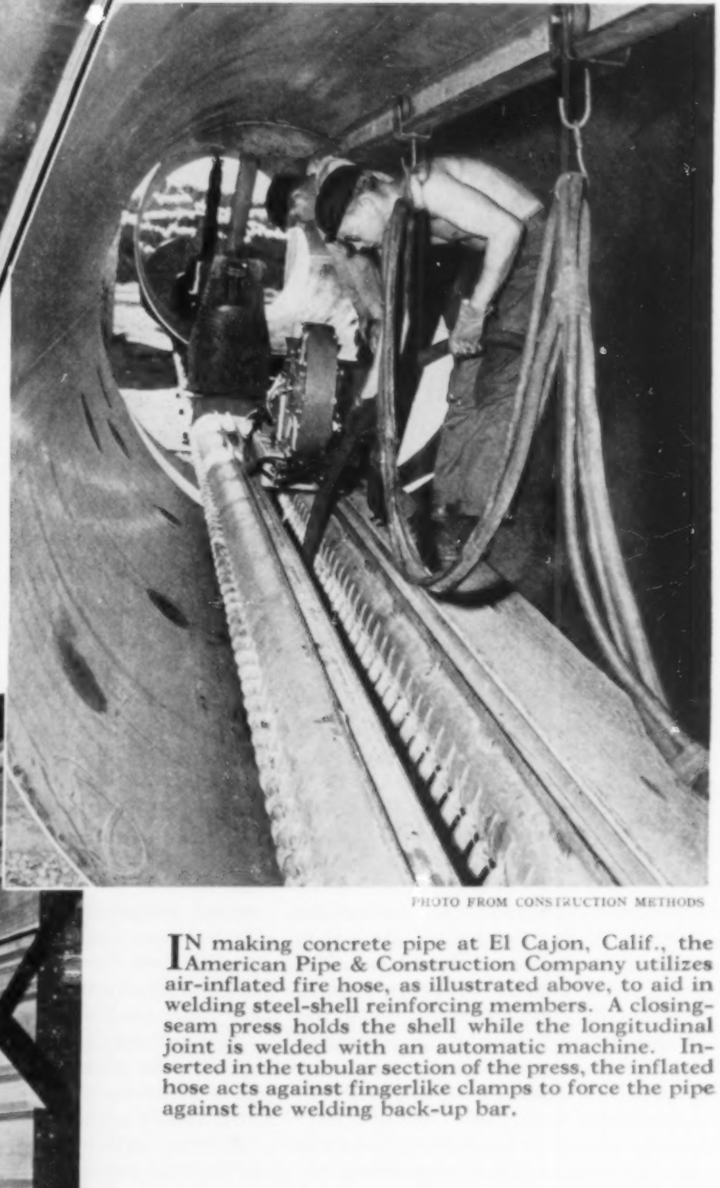
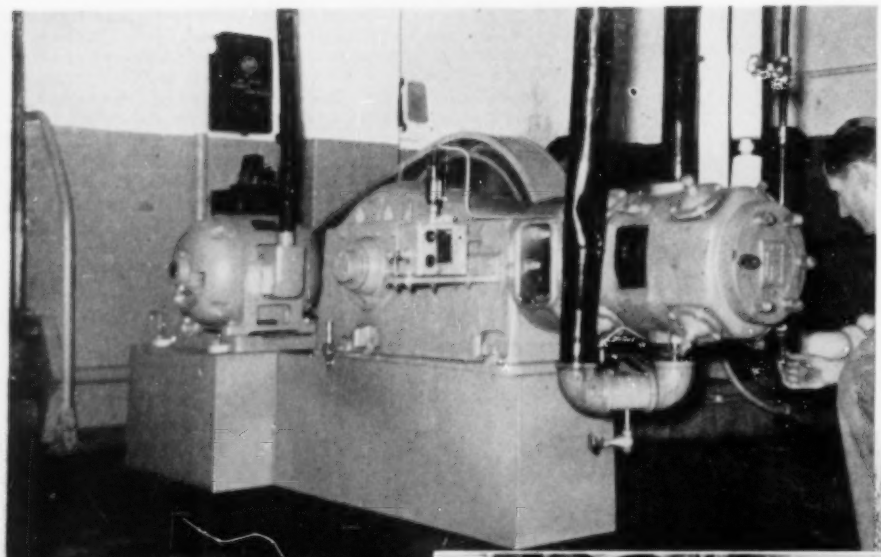


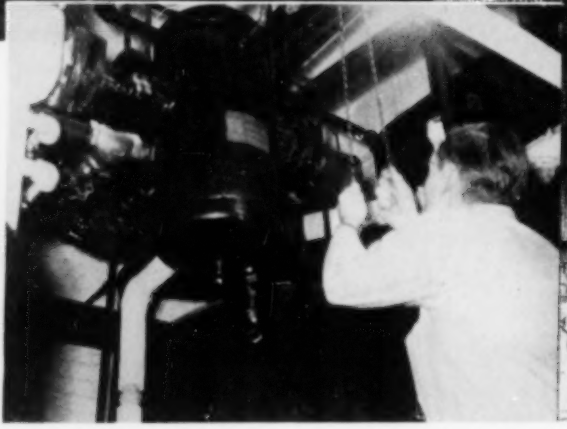
PHOTO FROM CONSTRUCTION METHODS

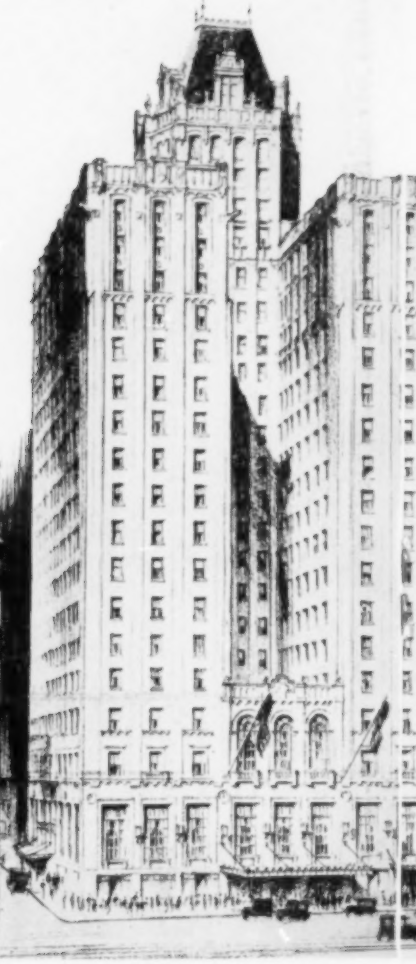
IN making concrete pipe at El Cajon, Calif., the American Pipe & Construction Company utilizes air-inflated fire hose, as illustrated above, to aid in welding steel-shell reinforcing members. A closing-seam press holds the shell while the longitudinal joint is welded with an automatic machine. Inserted in the tubular section of the press, the inflated hose acts against fingerlike clamps to force the pipe against the welding back-up bar.

●

MORE than $150,000,000 worth of war-surplus Navy airplanes are being stored in corrugated-steel containers to keep them in condition for almost immediate service in the event of a national emergency. The huge steel cans, some of which are 140 feet long, are made up in panels that are shipped to storage points at six naval bases and there fabricated by welding. Goodyear Aircraft Corporation is employing 300 men at Akron, Ohio, on this "canning project." The final preshipping operation is spray-painting the sections, as shown at the left.







COMPRESSED-AIR SERVICES
The 20-hp. Ingersoll-Rand compressor pictured above furnishes air for a variety of purposes, some of which are illustrated at the far right. From top to bottom, they show: a laundry press, controls of the hotel air-conditioning system, and pressure connections to kegs of beer. To insure moisture- and oil-free air, which is especially desirable in dispensing beverages, a separator (right) is interposed in the compressor discharge line.

ALTHOUGH the Lord Baltimore Hotel opened its doors to the public nearly nineteen years ago, it is today, as it was then, the largest, newest and most modern hotel in Baltimore, Md. That it has been kept strictly up to date is attributable to the foresight and thoroughness with which the structure was originally planned and the alertness of its management since then in keeping abreast of the times. Not only is this progressive policy evident throughout the public rooms, but it also extends beyond them to the extensive mechanical services that are necessary to operate a large hostelry efficiently.

As these "back-stage" facilities have been improved and extended, increasing use has been made of compressed air. When the hotel was built and equipped, compressed air was employed only in the laundry, where it operated five pneumatic shirt presses. A small air-cooled compressor driven by a 3-hp. electric motor was installed for this purpose. Since the laundry is located on the eighteenth floor of the 22-story building, the compressor was installed there rather than in the engine room in the subbasement to eliminate the necessity of long air-delivery lines. As the hotel laundry's reputation for doing fine work became better known, additional garment presses were needed. These were installed and obtained their operating power from the same air compressor. Meanwhile, accumulated dust was being blown from the windings of the numerous electric motors throughout the building with hand bellows and portable electric blowers. It was realized that compressed air would be more efficient, but there was no piping system to distribute it. To meet this situation, a duplicate of the original compressor was purchased and made readily portable.

The new compressor, motor, and starting rheostat (direct current was originally used throughout the building) were mounted on a sturdy 4-wheel truck, and a 50-foot length of 3-wire rubber-covered cable was connected to the unit. A plug connection on one end of this cable enabled the machine to operate wherever motors were installed, such as in the laundry, elevator machine rooms, kitchens, engine room, etc. Electric outlets, connected to the hotel's power circuits, were provided in all such locations. The third wire of the electric cable served to ground the compressor unit as a safety measure. The 50-foot air hose permitted it to be moved over a considerable area around each electric outlet and thus reach most of the motors.

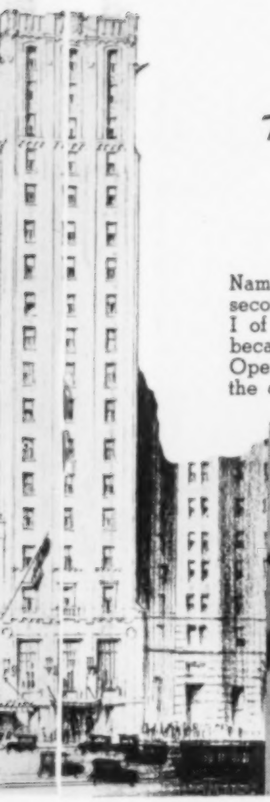
Furthermore, the new unit, by reason of its portability, could also be used as a temporary replacement for the laundry compressor when required. On several occasions the practicability of this plan was shown by the maintenance of laundry pressing operations despite unexpected breakdowns of the first compressor unit.

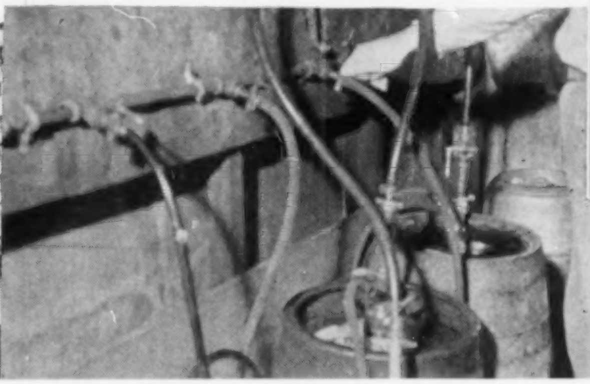
When the sale of beer was legalized, additional compressed air was needed. However, since only one bar was opened originally, it was considered advisable to purchase a small fractional-horsepower air compressor to take care of this requirement. The fact that the other compressors were not equipped with apparatus to remove oil from the air was another deciding factor, this being an undesirable characteristic where the serving of beverages is concerned. Subsequently, when additional bar facilities were opened, a second machine of the same type was provided to furnish standby capacity.

The need for more operating space in the laundry necessitated the removal to the engine room of the air compressor located there. The portable compressor was then also installed in the engine room and delivery piping was run to the eighteenth-floor laundry space. As alternating current was available in the engine room, 3-phase motors replaced the

Compressed Air in a Large Hotel

Thomas Trai





LORD BALTIMORE HOTEL

Named for George Calvert and his son Cecil, first and second Lord Baltimore, respectively, to whom King George I of England granted unlimited rights in the land that became the colony and, later, the State of Maryland. Opened in 1928, this 700-room hostelry (left) remains the city's finest.

original direct-current units. The controls on the two compressors were so arranged that one provided air for laundry and other requirements during the day while the other produced air for use in dispensing beer at the various bar locations and also for the operation of air-conditioning and heating damper and steam-valve controls during the night after the laundry closed down. However, in the event conditions were such as to demand a greater volume of air than normally, both machines could be operated in parallel.

This system was reasonably satisfactory, but the problem of excessive oil in the air continued. Oil was troublesome both because of the difficulty of keeping it out of beverage-serving systems and also because it tended to destroy the rubber diaphragms of the laundry-press controls.

Later, a need for additional compressed air in the laundry resulted from the purchase of a number of the latest type of automatic and semiautomatic garment presses to take care of the greatly increased output of the guest-laundry department.

It was decided at that time to retire all the small compressor units from regular service and replace them with a single heavy-duty machine that could not only take care of existing requirements but would also provide adequate capacity for all foreseeable additional future needs. The compressor installed is an Ingersoll-Rand Class "ES" single-stage, double-acting, water-cooled machine belted to a 20-hp., 2-speed, 3-phase motor.

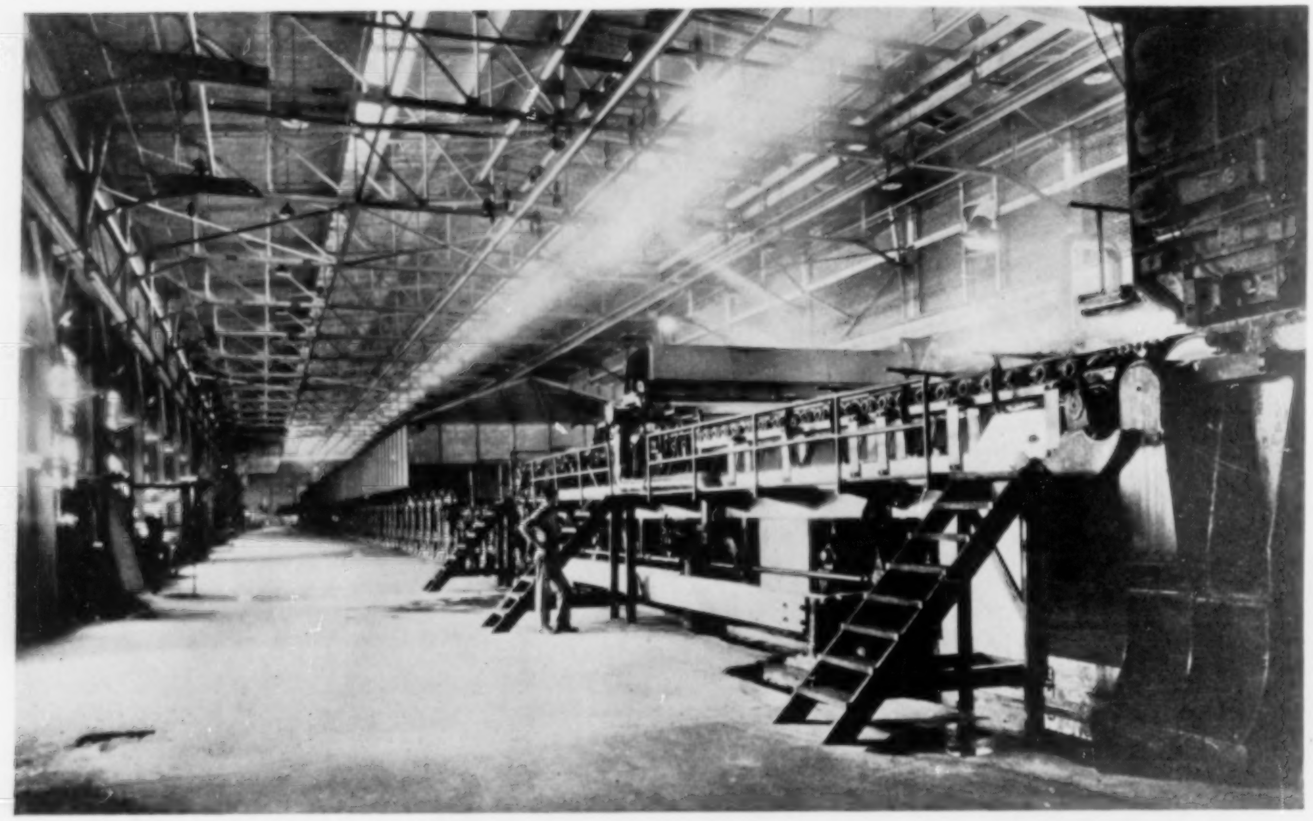
Normally, the compressor is operated during the day on half speed. This easily takes care of all compressed-air requirements throughout the building. When unusually large quantities of air are needed for such operations as blowing the accumulated dust from air-conditioning filters and for blowing out motors, it is sometimes necessary to switch the compressor to full-speed operation if the normal load is heavy. The change in speed is easily accomplished by merely shifting the handle of a drum-type controller.

The new compressor is equipped with an oil-and-water separator that aids greatly in removing these objectionable contaminants. Further, to insure a supply of moisture-free air to the damper and steam-valve controls of the air conditioning and heating systems in dining rooms and places of public assembly, an additional air receiver was installed inside one of the refrigerated food-storage boxes in the subbasement. The low-temperature atmosphere cools the compressed air stored in the receiver, thus causing additional moisture to drain from it.

The present compressed-air distribution system has been designed to provide efficient and safe handling of the air. Leaving the compressor at approximately 100 psi. pressure, the air is subsequently fed to auxiliary receivers at strategic locations throughout the building. The laundry uses air at 100 psi. pressure. This pressure is also employed in blowing dust from air filters and motors, although a valve-controlled nozzle is utilized for motor cleaning in order to regulate the pressure applied to the windings.

The high-pressure air from the main receiver is reduced through a valve to 25 psi. pressure and stored in the receiver supplying the beer-serving systems. Another reducing valve drops the pressure to 15 psi. for use in the damper and valve controls. Safety blow-off valves are provided in the various lines to protect the equipment against excessive pressures and to render it safe for the operating personnel. Gauges are placed at convenient locations in the systems to provide visual checks on operations.

The two small air-cooled compressors have been retained and are kept in standby service. They safeguard the system against the possibility of service interruptions in the event of equipment breakdowns and also permit the larger compressor to be shut down for periodic check-up.



FOURDRINIER MACHINE

This basic machine for making paper in an endless web is nowadays equipped with numerous air-operated control devices. It is named for its originators, Henry and Sealy Fourdrinier, who introduced it to England in 1803.

Air-Operated Devices Aid Paper Maker*

Fred R. Erbach†

CONDITIONS existing in the paper industry today call for an increase in machinery speed and a reduction in "down" or idle periods. This demand for more production from existing equipment has accelerated the development of refinements in the many control and operational devices used on machines of this kind. At the present time, these devices are variously powered by hand, weight loading, spring loading, hydraulic loading, electric-motor drive, and compressed air, the latter having proved itself to be especially well adapted for the purpose.

Manually controlled equipment such as levers and hand wheels for lifting press rolls and shifting mechanical clutches and belts not only involve physical effort but may demand the presence of the machine tender at one point when he should be at another. All this work can be practically eliminated by installing pneumatic clutches, belt shifts, and lifting devices operated by small levers conveniently located on the front side of the machine.

Weight levers on presses are cumbersome and require individual attention on both sides of a machine. Weights improperly applied may develop internal friction and result in unequal loading or faulty performance. Heavy weights possess considerable inertia, and when moved suddenly may cause pounding or jumping. Air-loading equipment used in place of weights provides a visual measure of the actual loads applied by indicating them on gauges, thus insuring uniform pressures which can be adjusted to meet service needs.

Spring loading, although suitable for many operations because of its simplicity, has mechanical disadvantages and may, under certain conditions, cause vibration when recoiling rapidly. Hydraulic cylinders exert a powerful force but lack the resiliency or cushioning effect that protects against sudden overload. Air, because of its compressibility, provides the necessary cushion, and any excess pressure may be released by relief valves to prevent overloading.

Electric motors operate many devices on paper-making machines and, generally, have proved to be satisfactory. However, in view of the damp and corrosive conditions usually found at the wet end of a machine, it may be desirable to eliminate this type of drive with its starters, conduits, and switches.

Compressed air as a power medium is highly adaptable because it can be made to do useful work in several ways by providing means for its expansion under controlled conditions. Straight-line motion is obtainable by allowing air under pressure to expand in a cylinder, while its expansion in an air motor results in rotary motion. And compressed air admitted to a diaphragm will, in expanding, exert considerable force with very little movement. Furthermore, air-operated devices may be manufactured of materials not readily affected by water, oil, heat, or corrosive substances and are usually rugged and of simple construction. Because of these factors, they stand up well in service and can be readily maintained by mechanics. With a heavy-duty paper-making machine or fourdrinier completely equipped for pneumatic control it is possible for the operator to have positive control over the machine at all times with a minimum of effort.

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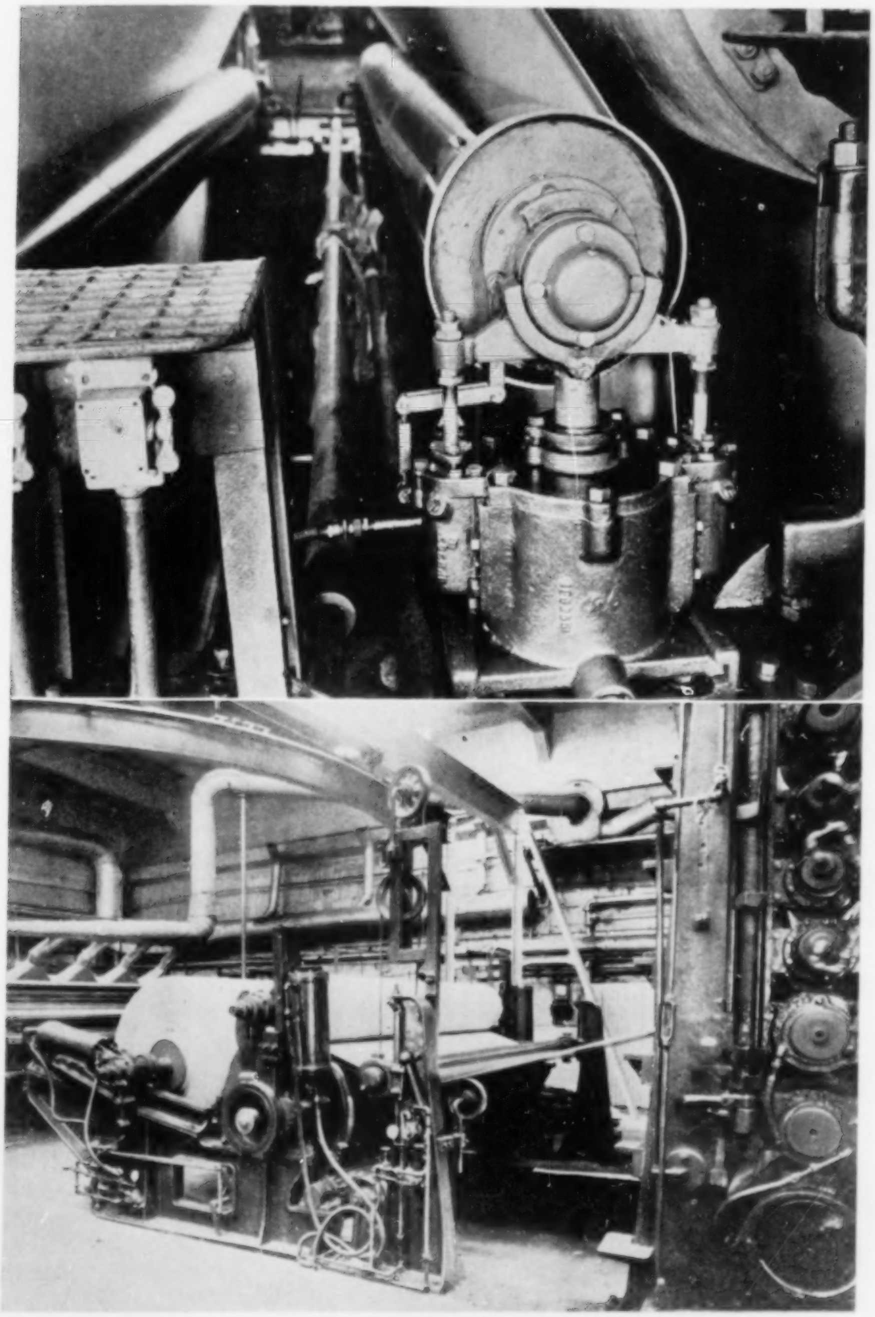
*Abstract of a paper presented at Chicago meeting of American Pulp and Paper Mill Superintendents Association, May, 1947.

†Beloit Iron Works, Beloit, Wis.

The types of air control used vary widely. Diaphragms serve mainly to actuate clutches, press loaders, and oscillators that involve only short travel. They readily adapt themselves without need of manual adjustment to whatever distances those devices must move to perform their functions. Clutches are designed so as to prevent the transmission of heat from the friction surfaces to the diaphragms; and because of the large effective diaphragm area, pressures of 7 to 10 psi. are sufficient. At these low pressures there is no danger of overloading the rotary air seals which furnish air to operating members. Proper control devices on the clutch supply line make it possible to regulate the pressure built up and thus prevent rapid engagement.

Mechanical drives using air clutches can be tied in with electric helper-motor drives. When a machine so powered is to be started, the motors are energized before the air clutch is engaged. In the event of failure in the electric circuit, the clutch is immediately disengaged. This protection prevents damage to felts, wires, and rubber-covered rolls, as well as to mechanical-drive parts of the installation.



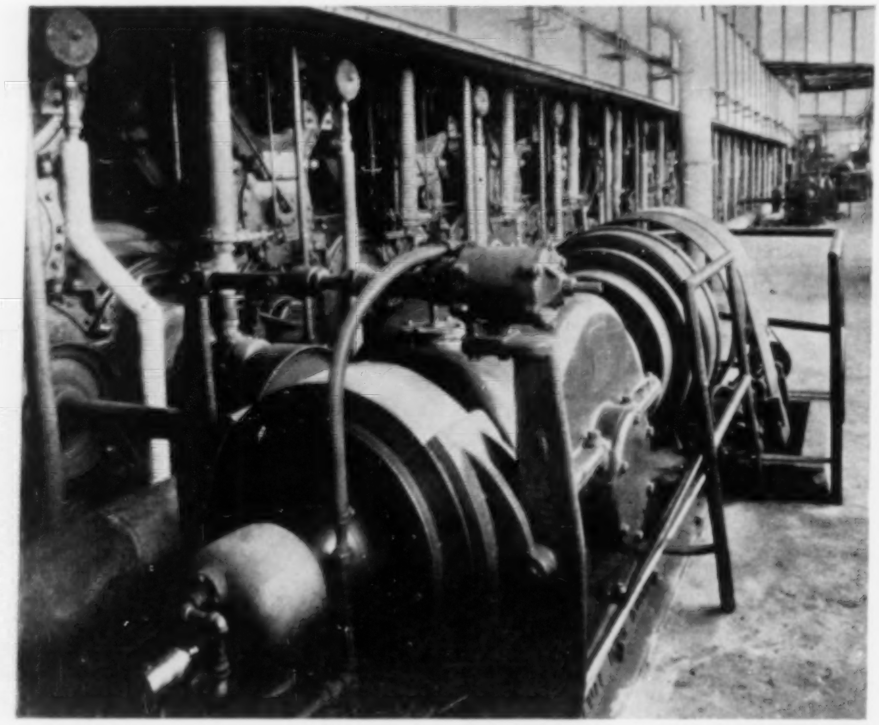
USES OF AIR CYLINDERS

At the top is shown a felt guide on a paper-making machine. The guide head on the roll and the guide-operating mechanism are both stationary, while the front guide roll, supported by a rod connected to the piston of a pneumatic cylinder, literally "floats" on air. On the Beloit heavy-duty board-machine reel seen in the lower picture, air cylinders are utilized to maintain the desired pressure on the reel drum.

Air readily lends itself to the operation of brakes which, on drives for large drier sections, overcome the inertia of high-speed machines whose antifriction bearings would otherwise permit them to function for some time after the clutches are disengaged. Calender stacks that are powered by slow-speed, gear-head reversible motors are another example of air-clutch application. A control valve admits air to the main clutch to move the calender stack forward. When it is necessary to reverse the direction of travel the valve is shifted to another position, thus cutting off the air supply to the main clutch and routing it to the clutch on the back-up motor drive. Because the machine tender can disengage and engage the calender clutches simply by manipulating the control valve, the down time usually required to get a plug out of the stack is greatly reduced and the task is made much safer.

Press-roll loading by means of air-operated diaphragms is another important development. A simple lever serves to multiply the diaphragm force to load the roll, and pressure can be applied to both the back and the front end by operating one valve. Loading may be uniform, or, if pressure regulators are provided, a different load may be exerted on each end.

Air-operated cylinders, both single- and double-acting, are used extensively on paper-making machines, one of their principal applications being in connection with center-wind and board reels. In the case of the latter, double-acting units are mounted in a vertical position with their lower ends engaging roller levers to hold down the spool when it is winding paper on top of the drum. Pressure can thus be exerted to prevent jumping when a new roll is started, and the pistons can recede automatically as the roll of paper increases in size. After the transfer of the paper from primary arms to an incline table, a set of double-acting cylinder pistons applies pressure against the journals of the spool. The hardness of the roll is controlled by pushing it against the drum. Air gauges on the supply lines accurately indicate the working pressures, and the operator can easily change them to meet the needs of the particular sheet or board to be run. Where a reel has several controls, they are usually arranged on one panel for fast, convenient operation with the least broke—waste pulp and damaged paper.



BRAKING WITH AIR

The gear box in the foreground transmits power for driving the paper machine (left) and is equipped with a quick-acting air brake to stop the multiple-roll, high-speed assembly. The brake drum and shoes, at the near end of the gear box, are operated through connecting rods by the horizontal pneumatic cylinder mounted on top and having an air-supply hose leading to it.

On center-wind reels, double-acting cylinders are used to actuate the belt-tightener, to engage the center-wind clutch, and to assist in lifting heavily loaded transfer arms. They also provide the reciprocating motion necessary to drive oscillating doctors and showers and perform other functions in connection with winder-shaft transfer equipment, rider-roll lifts, winder-shaft lifts, winder-gate lifts, and winder-sheet threaders.

One of the most successful of the air-cylinder applications is that in the case of the automatic air guide. The front end of the guide roll floats on a cushion of air, and a Witham head on the roll actuates a small slide valve which admits air to the cylinder that supports the guide roll. Because of the lightness of the mechanism under its control, the Witham head is sensitive to slight variations in the position of the felt, onto which the paper is transferred from the wet end of the machine. Incorporating no palms, ratchets, or continually operating screws, the device requires little servicing and is easy on the felt.

Air motors are a convenient source of power for drives which must be reversed frequently or rapidly, which must move heavy loads at slow speeds under positive control, which may be stalled for long periods, and for intermittent drives calling for a high starting torque that has to be regulated. Such motors are available with either high-speed shafts or with enclosed gear reduction, and are readily reversible by shifting the air inlet from one port to another.

One interesting air-motor application is on removable fourdrinier machines where it is necessary to swing the breast roll back in order to give ample slack to the moving wire on which the sheet is formed. The breast-roll supporting arms have gear segments for raising or lowering the roll. A portable air motor furnishes the driving power, and may be disconnected when not needed. Air motors also serve as fourdrinier-remover drives, and are mounted directly on the frame of the machine. The hose which supplies air to the motor is provided with flexible connections and may be removed when the drive is not required. Control valves are located adjacent to the motor so that the operator can start it and drive the fourdrinier across the aisle under complete control.

On high-speed paper-making machines of considerable width, the main slice, which spreads the pulp evenly on the wire from side to side, is quite large and heavy and must be raised and lowered slowly under positive control. This is done by vertical lift screws which are driven by a reversible air motor through worm-gear reducers and permit the operator to move the slice into the exact position required.

Stock flow to the fourdrinier is controlled by large regulating valves in the supply lines. These valves may be opened or closed by driving the valve stems by air motor through suitable gear reduction. With this arrangement, no special devices are needed to limit travel in either direction. Controls for both the flow valves and the slice lift may be grouped at some convenient point on the machine floor, thus enabling the operator to regulate the stock feed to the wire without lost motion. Felt stretchers, belt shifters, and press-roll lifts also may be driven by air motors controlled from the same or a nearby central station.

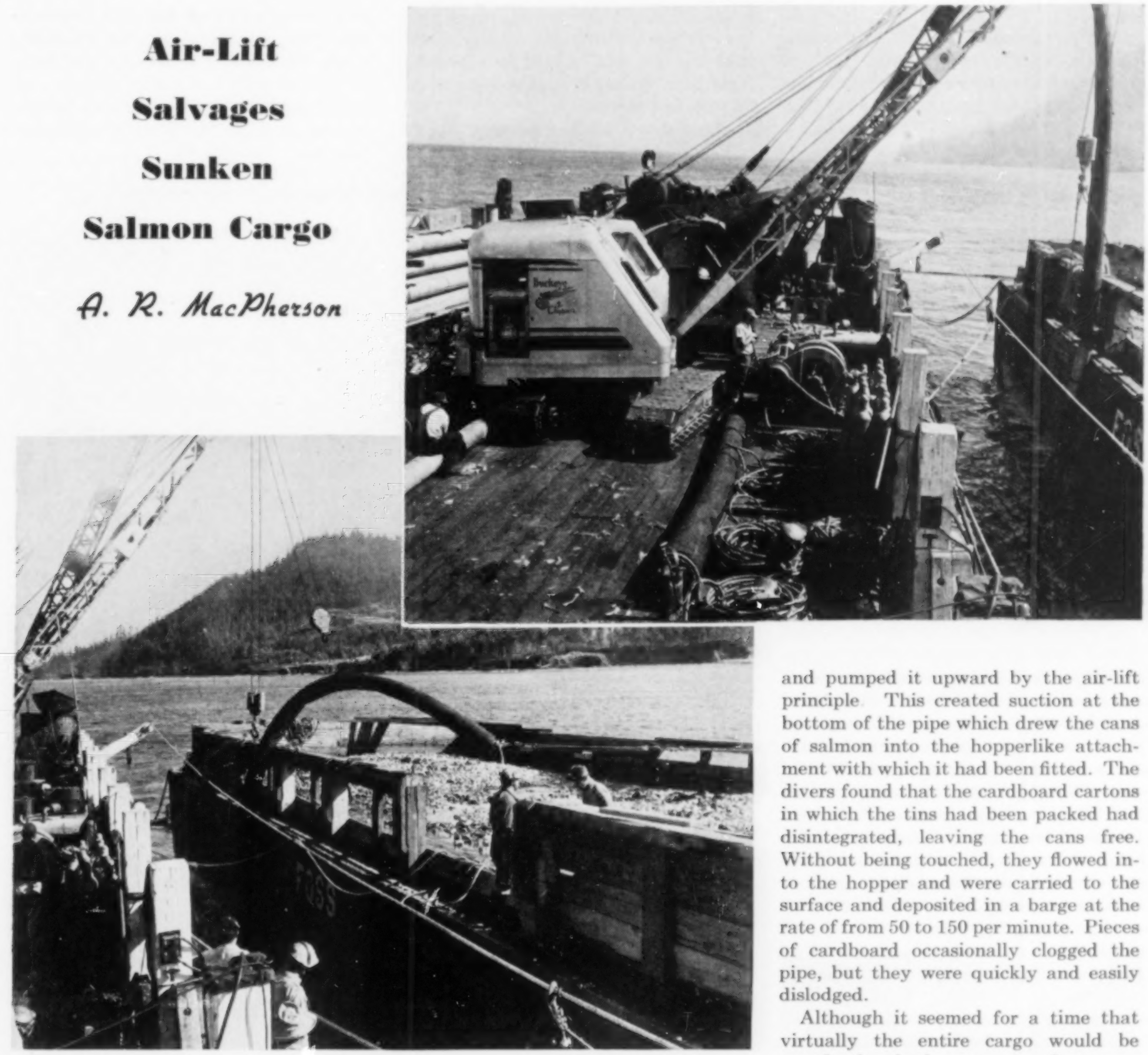
These are only some of the compressed-air devices that are being used successfully on paper-making machines, but they suffice to show how, by supplanting slow, manual operations, they are helping to increase production.

JEEP TOWS COMPRESSOR

Having proved their adaptability during the war, jeeps are now performing diversified tasks in the civilian world. Here one of them is shown towing an Ingersoll-Rand 315-cfm. portable air compressor in the Coeur d'Alene mining district of Idaho. The machine was being moved to the new Rock Creek Shaft being sunk by the Hecla Mining Company.

Air-Lift Salvages Sunken Salmon Cargo

A. R. MacPherson



UP FROM THE DEEP

At the top is a general view aboard the work barge showing a crane handling the flexible steel pipe through which the cans of salmon were carried to the surface by water pumped by air lift. The discharge end of the pipe, with recovered cans of salmon on the floor of the barge, is pictured below.

ON THE thirteenth of August the freighter *Diamond Knot*, heavily laden with a $3,500,000 cargo of canned salmon from Alaska, was bound for Seattle, Wash., on Puget Sound. While proceeding through a dense fog just west of Port Townsend in the Straight of Juan de Fuca she was run into by the coastal freighter *Fenn Victory*, outward bound. The latter carried the rammed vessel on her bow for several hours in a desperate effort to keep her afloat, but the *Diamond Knot* and her valuable cargo, representing nearly 10 percent of Alaska's season catch of salmon, sank to the bottom in 120 feet of water. Fortunately, there was no loss of life, and the *Fenn Victory*, little damaged, returned to Seattle under her own power.

The owners at first reported that the much-needed food would be a total loss, but they did not reckon on the ingenuity of two Tacoma firms, the Walter Mc Cray deep sea divers and the Foss Launch & Tug Company. Assembling tons of barges, cranes, tugs, and diving equipment, those two concerns took over the precarious job of salvaging 7,392,000 cans of salmon packed in cardboard cartons in the holds of the sunken freighter.

Divers succeeded in guiding a special 12-inch flexible steel tubing into the interior of the *Diamond Knot* and then connected a compressed-air line to the pipe about 2 feet from its lower end. When air at a pressure of 125 psi. was admitted, it aerated and lightened the overlying water column in the tubing and pumped it upward by the air-lift principle. This created suction at the bottom of the pipe which drew the cans of salmon into the hopperlike attachment with which it had been fitted. The divers found that the cardboard cartons in which the tins had been packed had disintegrated, leaving the cans free. Without being touched, they flowed into the hopper and were carried to the surface and deposited in a barge at the rate of from 50 to 150 per minute. Pieces of cardboard occasionally clogged the pipe, but they were quickly and easily dislodged.

Although it seemed for a time that virtually the entire cargo would be saved, the final recovery, after some two months of work, amounted to 120,000 of the 154,000 cases, or approximately 78 percent of the total. It was discovered that the contents of about 20,000 cases had been destroyed by the terrific impact of the collision, and that 14,000 were stowed in inaccessible compartments of the vessel. All the cans recovered are being opened and examined by Federal inspectors, who are finding the salmon almost uniformly in edible condition. It is being recanned and relabeled at various Puget Sound canneries and will be helpful in relieving the world food shortage.

Aboard the barge from which the unique salvage operations were conducted were five portable air compressors. Four of them, with an aggregate capacity of 1155 cfm., furnished air for lifting the cans. The fifth, of 60 cfm. capacity, supplied breathing air to the divers, who were on duty continually within the *Diamond Knot* to make sure that the pipe bottom was always in a position to receive cans from the progressively receding piles. Twelve anchors, ranging in weight from 2500 to 7000 pounds each, were used to hold the work barge over the sunken ship. The 2½-inch chains attached to them had a total weight of 40 tons. A Buckeye Clipper crane handled the anchors and did other heavy lifting work.

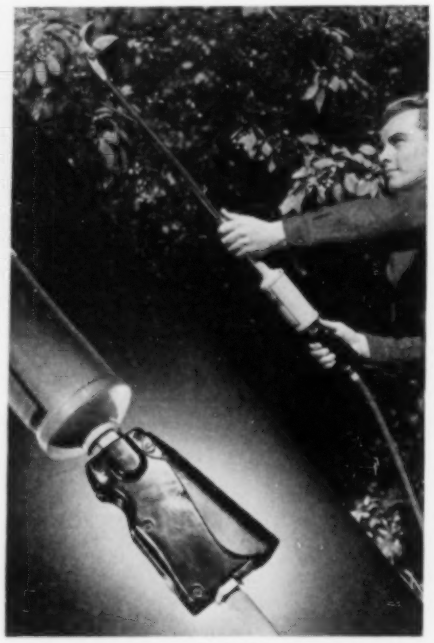
Marine men say the *Diamond Knot's* cargo was the most valuable ever to go down in American North Pacific waters. They can recall no previous salvage job where such a novel procedure was followed. Never before did a case arise where thousands of fish once caught and canned had to be caught and canned a second time and, in the course of the process, be literally lifted out of the sea with compressed air. Long one of the essential tools of salvors, compressed air has been applied in an unusual way. Approximately 70 men were engaged in the operations. Salvage Chief Walter L. Martigoni was in general charge and Chief Diver Art McCray directed the work of the divers.

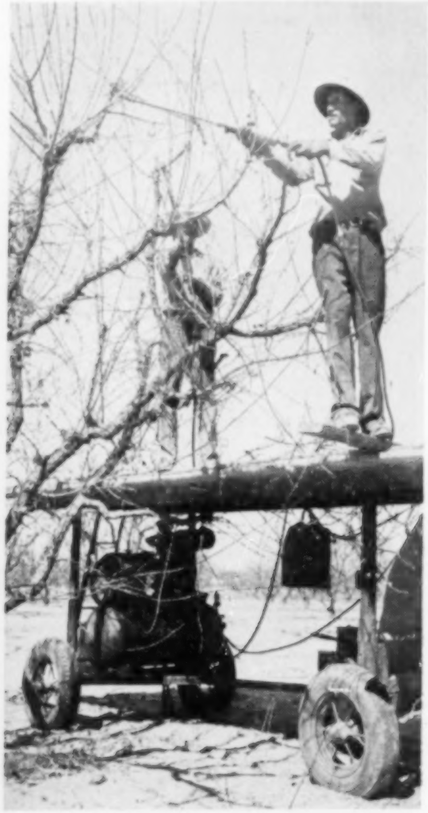
The collision has given rise to a legal tangle that may require years to unravel. The Alaskan Steamship Company, owner of the *Diamond Knot*, filed a $1,000,000 maritime libel suit against the *Fenn Victory*, owned by the Federal Government and operated by the American-Hawaiian Lines. However, the suit was dismissed by the U. S. District Court Judge John C. Bowen of Seattle who ruled that since the *Fenn Victory* was owned by the Government the court had no power to seize her. What the next legal step will be remains to be seen, but in view of the costly salvage operation and the total loss of the *Diamond Knot* it is probable that litigation will be long and expensive.

There was a tragic aftermath to the collision. Although officials of the company that employed him had absolved him from all blame for the accident, Capt. Joseph A. Gaidsick of the *Fenn Victory* brooded over the misfortune and took his life a short while before he was to appear at a Maritime Commission hearing.

GETTING READY
The two divers shown here are being assisted into their protective clothing preparatory to descending to the sunken cargo ship 120 feet underwater.

Air Power Now Prunes Trees





IN SERVICE
At the right are shown two Limb-Loppers being operated from a movable platform having a small gasoline-engine-driven, air-cooled compressor mounted underneath it. In the other picture are a close-up of the tool and, below it, details of the molded Tenite handle.

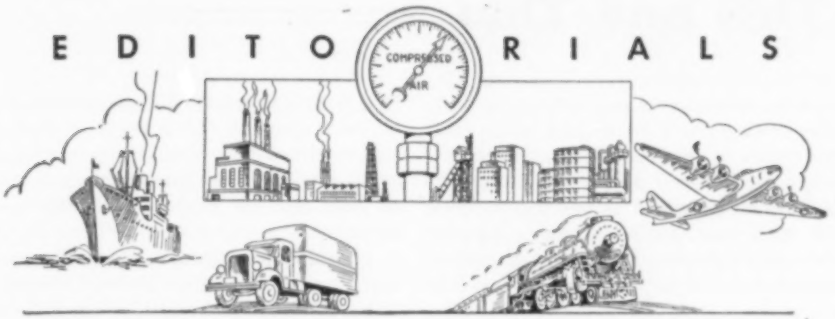
AN AIR-POWERED pruning tool recently introduced should prove useful and economical in orchards, vineyards, parks, and other areas where large numbers of trees, vines, or shrubs must be trimmed regularly. Termed the Limb-Lopper, the device is said to speed up pruning considerably and to eliminate operator fatigue.

A pneumatic cylinder controlled by a handle valve is used to actuate the forged-steel cutting head with which the tool is equipped. A 1¼-inch hose feeds compressed air through the molded Tenite handle into the cylinder. The valve is both opened and closed by air power, no springs being utilized. An 8-cubic-foot compressor run by a 1¾-hp. motor will serve one Limb-Lopper, while two to four tools may be operated from a 12- to 17-cubic-foot machine driven by a motor of from 2¾ to 5 hp., the capacity varying with the type of work being done.

Manufactured by the Miller-Robinson Company of Los Angeles, Calif., the tool is available in two sizes. The larger model cuts green limbs having a maximum diameter of 1¼ inches, and shank lengths of 12 to 54 inches may be specified. Total weight of the device is in the neighborhood of 6 pounds. The smaller model cuts green wood up to ¾ inch in thickness and may be fitted with shanks from 3 to 72 inches long. It is primarily designed for light pruning work such as trimming vines, berry bushes, and shrubs. Both sizes are operated with air at from 90 to 140 psi.

Reports of users of the Limb-Lopper indicate that it will do from 35 to 600 percent more work than hand shears, depending upon the growth trimmed and the facilities such as portable platforms available for reaching high tree branches. Cuts made by the tool are sharp and clean; no ragged, chewed, or split ends are left to invite decay.

EDITORIALS



MECHANIZED ROADBUILDING

TWENTY-FIVE years ago, roadbuilding was largely a muscular undertaking, with both men and draft animals supplying the muscle. Such dirt-handling machinery as was available—primarily scrapers and wagons—was very simple. Consequently, despite a low wage scale, the average cost of excavating and moving a cubic yard of earth was more than 40 cents. Mechanization began with gasoline-engine-powered equipment in 1924, in which year the average bid price per yard of earth was 39 cents, according to figures gathered by the Public Roads Administration.

Remarkable strides have been made by machinery builders since then, and it is only through their efforts that highway construction costs have been kept within tolerable limits in the face of continually rising wages and a demand for wider, heavier, and better-aligned roads. When the diesel-power era dawned in 1928, handling costs per yard declined to 34 cents in six years. Then came a minor revolution in the design of equipment, with tractor-drawn trailers replacing conventional trucks. Each hauled from ten to twelve times the load of the old 1½-yard horse-drawn wagon, and at twice the speed. By 1940, these and other new types of large equipment had reduced the rate of handling a cubic yard of dirt to 21 cents.

By that time there were in use self-loading scrapers of the carryall type with capacities up to 23 cubic yards. Pulled by one tractor and pushed by another during the loading run, such a unit moved 68 yards an hour on a 2000-foot haul. This figures out at about 46 times the average performance with horse-drawn scrapers prior to 1924. In addition, the economic length of haul for scrapers had been increased from 600 feet to 2500 feet. The significance of this becomes clear when it is pointed out that the average hauling distance on grading operations in 1940 was double that in the premechanical period. Even larger and more efficient machines appeared during the war in answer to the demand for speedy construction of military roads and airports. Typical of present-day power-drawn, power-controlled giant earth carriers is the machine shown on page 302.

Coincident with these advancements have come progressive improvements in equipment and methods of drilling, blasting, and handling rock. Rock drills have been available to roadbuilders for well over half a century, but there has been a notable step-up in their performance during the past twenty years. This has resulted both from gains in operating efficiency and from the introduction of mountings that make heavy-duty drills highly mobile.

Today's pneumatic-tired wagon drills, operated by portable compressors, will put in blast holes several times faster than could the hand-held or tripod-mounted units used by contractors in the 1920's. Better explosives and blasting practices and quicker-acting power shovels of larger capacity that load into tractor-trucks of unprecedented payload proportions have likewise contributed their share to the more economical handling of rock. All in all, rock moving has kept pace with dirt moving in the transformed road-building technique.

ROBERT GREGG SKERRETT

ROBERT G. SKERRETT, editor of COMPRESSED AIR MAGAZINE from 1922 to 1932, and a contributor both before and after that period, died at his home in Maplewood, N. J., on November 5, following an illness of several weeks. He was 79 years old.

Mr. Skerrett was born in Hamilton, Va. His father, Joseph S. Skerrett, was a naval officer who, as rear admiral, had charge of our fleet when President Theodore Roosevelt sent it around the world in 1907 to display its power to foreign governments that were making warlike gestures.

Mr. Skerrett spent his boyhood around naval yards and depots to which his father was attached and acquired an understanding of and interest in naval affairs that he retained throughout his life. In fact, although he was graduated from the law school of Georgetown University, Washington, D. C. (L.L.B., 1891, L.L.M., 1892), he chose to go to work in the Navy Department rather than practice his profession. Among other duties, he illustrated the Naval War Records.

He left the Navy Department after four years to become publicity man for the Lake Torpedo Boat Company of Bridgeport, Conn., which, failing to gain recognition in this country, sought to interest foreign nations in its even-keel type of submarine. He was abroad with Simon Lake, the boat's inventor, from 1904 to 1908, working first in Russia, where he took part in the submergence trials of the submarine *Protector* which the Russian government had purchased, and then in Germany and England.

Upon returning to the United States, Mr. Skerrett became a free-lance writer in New York. He contributed regularly to the *Scientific American* and the Sunday supplement of the New York *Sun*. He specialized in naval articles, but also covered a wide range of scientific, industrial, and popular subjects for these and other publications. During that time he was instrumental in organizing a company to promote the Emil Gathmann ingot-mold patents and in negotiating for the purchase of an Italian-type of submarine by our Navy.

In July, 1920, he became contributing engineering editor of COMPRESSED AIR MAGAZINE, and was made editor in July, 1922. After filling that post ably for ten years, he resumed free-lance writing in January, 1932, contributing regularly to this magazine and others, among them *The Engineer*, of London, and the French technical periodical *Le Technique des Travaux*. His most recent article in our pages, *Doughnuts Now Big Business*, appeared last month. When stricken by his final illness he was working on several manuscripts for us, some of which may be far enough along to permit publication.

Mr. Skerrett was a member of the American Society of Naval Engineers and maintained close relations with the Navy Department throughout his life. His personal contacts and familiarity with the departmental procedure enabled him to be the first to obtain material for many special articles. An example of this was his preparation for us of a detailed account of the salvage of the sunken submarine *Squalus*, which went down off Portsmouth, N. H., on May 23, 1939, while on a trial run. Two days after his authoritative, Navy-approved article had been published, it was announced in Washington that President Roosevelt had just received his official report on the salvage operations.

Mr. Skerrett had made his home in Maplewood for the past 25 years. He is survived by his widow, Mary Preston Skerrett.

This and That

Corn as Basis of Industry

Not so many years ago, virtually all cultivated crops were consumed as food (or drink) by animals and human beings. Nowadays, however, many field products are being used for other purposes in steadily increasing quantities. Recent published comments on our short corn crop have revolved principally around the effect the deficit will have on the food situation. While this is of primary concern, it is also true that many nonfood industries will feel it keenly.

As pointed out in a recent issue of *Agricultural and Industrial Progress in Canada*, the case of corn illustrates the great and growing interdependence of agriculture and industry. Aside from being processed into numerous edibles (syrup, breakfast food, salad oil, glucose, dextrose, etc.), corn has countless industrial applications. In the form of cornstarch or its derivatives it is used in laundries, for giving rubber articles and foundry molds a smooth surface, as a binder in medicinal tablets and match heads, as a component of some explosives, in the making of rayon, as a size for paper and textiles, as an ore-settling agent in metallurgy, as an ingredient of cleansing solutions, as well as a vehicle for holding tanning extracts in the leather industry and moisture in the tobacco industry. Corn also enters into the manufacture of electrolytes for recharging dry cells and serves as soap stock—a fatty acid made from corn oil. At least 15 processing and manufacturing industries other than those related to food products regularly use corn or something made from it.

* * *

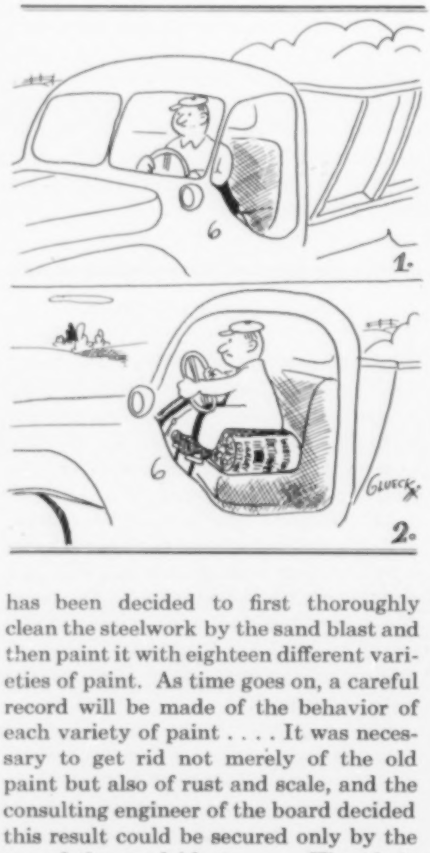
Vertical Drains for Highway

In building a 5-mile sec- of a 6-lane highway on reclaimed marsh and tideland along the shoreline in Burlingame, Calif., the contractor has to cope with mud deposits ranging up to 60 feet deep. Where the mud is relatively shallow, it is removed and replaced with more stable ground; but where it is 15 feet or more deep, provision is being made for consolidating it by introducing sand drains. These are vertical and are spaced on 10-foot centers, and it is estimated that they will aggregate 235,000 lineal feet. Each drain is a circular hole, 18 inches in diameter, filled with carefully graded sand and extending to relatively firm bottom. To sink it, an 18-inch pipe, equipped with a plate to close the bottom, is driven to the required depth with an air-operated hammer working in 80-foot leads hanging from the boom of a crawler-mounted crane. When in position, the pipe is backfilled with sand through a hopper and is then withdrawn while compressed air at a pressure of 100 psi. is admitted at the top to force the sand past the free-hanging bottom plate into the hole. After the drains have been put in, a 12-inch layer of sand is placed on top of the area affected. The purpose of this blanket is to permit water brought up through the vertical pipes to flow away. Because of the difficulties attending its construction, this stretch of highway, which is known as the Bayshore Freeway, will cost $3,250,000, or the equivalent of $650,000 per mile.

* * *

Sand Blasting in 1897

In its "50 Years Ago" column, the *Scientific American* (October) republished the following from its October, 1897, issue: "The massive steel viaduct which carries 155th Street across the terminal station of the Manhattan Elevated Railway has suffered serious corrosion, as the result of the gases which are continually playing upon it from locomotives of the road . . . . It has been decided to first thoroughly clean the steelwork by the sand blast and then paint it with eighteen different varieties of paint. As time goes on, a careful record will be made of the behavior of each variety of paint . . . . It was necessary to get rid not merely of the old paint but also of rust and scale, and the consulting engineer of the board decided this result could be secured only by the use of the sand blast . . . . The air is compressed by two Ingersoll-Sergeant machines, which deliver to a receiver which has a capacity of 30 cubic feet . . . . The nozzle is 8 inches in length with a $^9/_{16}$-inch opening, and is made of chilled iron with a view to resisting the abrasion of the sand . . . . The speed of the mixture of sand and air is about 300 feet per second."



Another item from the same issue, headed "Pneumatic Tubes," reads: "Shortly after noon on the 7th instant the first section of the pneumatic postal tube service, which is now being installed in this city, was opened for regular service . . . . There are two tubes, each 8½ inches in diameter, the bends being made of brass and the straight sections of cast iron. The interior surface is smoothly finished off to assist the passage of the carriers. The air-compressing plant is located at the General Post Office, and a pressure of 6 pounds to the square inch is employed for the present, though pressure and speed may be increased if desired."

* * *

Boy "Sees" Treasure in Earth

Through the ages, certain individuals, claiming to be endowed with occult powers, have professed their ability to locate water or minerals in the ground with a forked bough. Although never given credence by scientists, these diviners have been able to give impressive performances, and even today some of them ply their trade for a fee and succeed in getting an occasional assignment. From South Africa comes word of a youth, 16-year-old Pieter van Jaarsveld, who seemingly outdoes even the "water witchers." Using only his eyes, to which some attribute X-ray properties, he is reported to have spotted underground gold- and diamond-bearing deposits and watercourses.

According to The *New York Times*, when the boy was taken on test flights by mining men, he accurately outlined the gold-bearing reefs in the Orange Free State even though there are no surface indications of their presence. Pieter says that a black ridge appears before his eyes when he passes over gold ore, that diamondiferous ground produces a heat haze, and that underground water gives off vibrations akin to moonbeams. While at Salisbury, in Rhodesia, one night, the lad could not have a bath because of a water shortage. Declaring that he could remedy the situation, he asked the mayor and chief engineer to drive him around the city. On the outskirts he traced on the surface several supposedly underground streams and, on the strength of his assertions, the boring of a test well was begun. A local gold-mining syndicate is said to have given Pieter a job as a diviner.

Industrial Notes

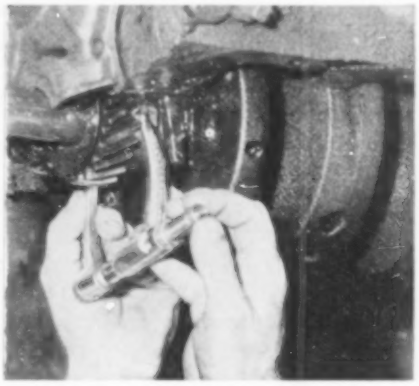
An 8-ton mine locomotive built for both slow and high speed has been announced by the Westinghouse Electric Corporation. It runs from creep to 5 miles per hour when gathering cars near the face and up to 7½ miles an hour on the main haulage line. The respective speeds are obtained by operating the motor on full field from a reel and on shunted field from a trolley.

Spring-type sheet-metal fasteners are inserted or removed at the San Diego plant of the Vultee Aircraft Corporation by a pneumatic tool that was developed there. It is made up of a long handle containing a small air cylinder and spring and of lever-controlled jaws. In operation, a fastener is positioned in a rubber cap which is placed in the jaws. Air at normal shop-line pressure is then admitted to the pneumatic cylinder through the handle to close the jaws which, in turn, compress the spring of the fastener so that its clasp can be inserted in corresponding holes in two or more layers of metal. Release of the lever or pressure opens the jaws, allowing the fastener spring to expand and hold the metal pieces in tight contact. Use of the rubber cap prevents the work from being damaged even in case the air is unexpectedly turned off. Removal of a fastener from holes that have become misaligned through distortion of the separate sheets or other causes during assembly is similarly effected. The tool is said to operate quickly and effectively with less danger to workers and none of the fatigue resulting from the use of conventional hand "squeezers."

Using an alloy of bismuth, tin, and lead, research engineers of the Ford Motor Company are said to be saving weeks in the production of small dies needed for experimental purposes. Normally the metal is too soft to withstand the pressures to which dies are subjected, but when it is chilled in liquid nitrogen its surfaces become as hard as ordinary brass. From six to ten stampings can be obtained from a die between chillings. Instead of waiting from six to eight weeks for the delivery of steel dies, laboratory men can provide themselves with both dies and sample parts in from 24 to 48 hours.

Production of aluminum-silicon alloys from alumina and kaolin as practiced at the Lurgi-Thermie plant in Herrem, Germany, is the subject of a British report (PB-63688) obtainable from the U. S. Department of Commerce. Briefly, the electrothermic process involves briquetting a mixture of powdered alumina, crushed kaolin, oil, coal, and charcoal. The briquettes, which are egg-shaped and 3 inches long, are stored for about eight days for thorough drying. Then they are smelted with silica in a furnace to provide an aluminum-silicon alloy containing 40-60 percent silicon. After refining in an electric-arc furnace the product is finally alloyed with metallic aluminum in a gas-fired melting furnace. The yield is silumin with a silicon content of 12 percent. The report, entitled *Electro-thermic Production of Aluminum-Silicon Alloys*, is distributed by the Office of Technical Services, Department of Commerce, Washinton 25, D. C. It is available in either photostat or microfilm form, price $1.00.

For measuring journal diameters without removing a crankshaft from the engine block, the Tubular Micrometer Company is offering a new direct-reading micrometer with a reach sufficient for all sizes of crankshafts. Primarily designed for shafts on combustion engines, it may be applied to compressors, pumps, and similar equipment using eccentric-power motion. The arms are of forged steel having ground and lapped contact surfaces that are adjusted simultaneously with a micrometer screw. The latter is said to insure measurements that are accurate to within one-thousandth of an inch. Both graduations and numerals are easy to read and are recessed in a window-type opening in the micrometer frame where they are protected from dirt and damage. Range is calibrated either in from 2 to 3 inches or 50 to 75 millimeters, as may be desired. The instrument permits a me-



IN USE

In measuring a crankshaft, the bearing cap is removed from the main journal, as shown. Crankshaft sag then permits arms to pass over half of the bearing-surface radius. After adjustment of the micrometer screw has brought tips into contact position the instrument is removed and reading taken directly from that setting.

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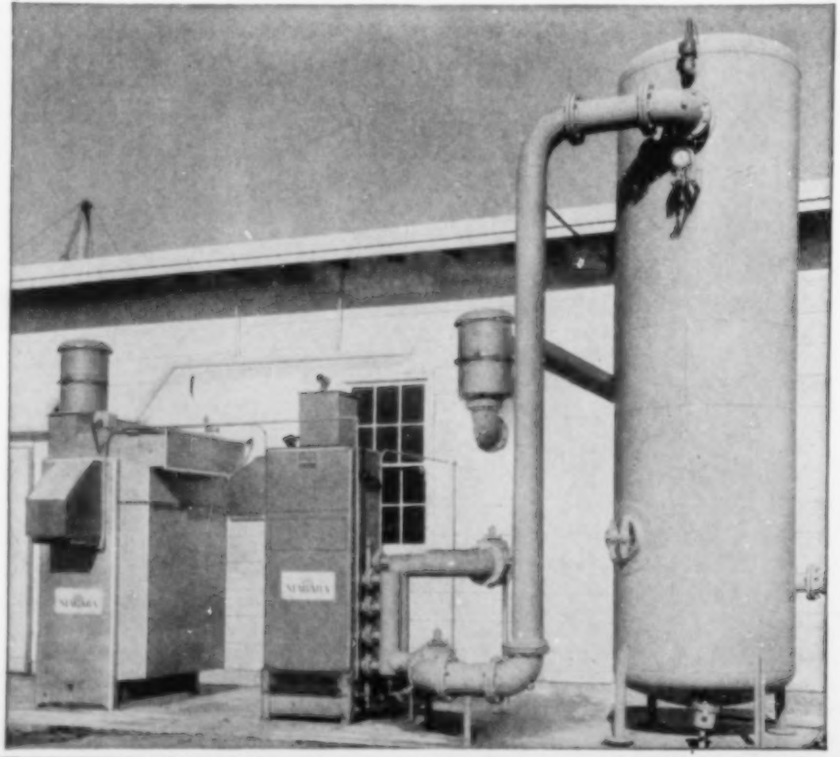

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chanic to determine crankshaft diameters where oil lines or other internal motor obstructions would interfere with standard micrometer-type calipers.

After a long absence, toys from Germany are again on our counters. One that is sure to delight the heart of a boy is an aluminum racing car that is said to run more than 15 miles an hour on compressed air.

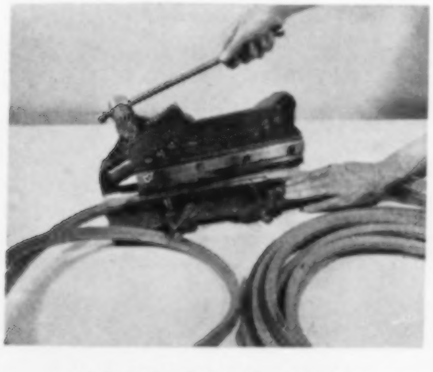
Development of a new intake air cleaner-silencer for use on internal-combustion engines, compressors, and blowers has been announced by the Burgess-Manning Company. Designated as Series ICS, the unit, which is available in pipe sizes ranging from ¾ inch to 6 inches, is said to differ radically from conventional types. The body contains a surge chamber that is designed to smooth the flow of intake air and to dampen noisy pulsation, and the nonferrous filter is held in place by sturdy snaps attached to the heavy steel housing to prevent loss. This construction permits of quick removal of the filter for cleaning or replacement.

According to a newspaper-syndicate service, the first aircraft-carrier planes flown by the British had large canvas bags mounted underneath them to permit landing on water. As the craft descended, the bags were inflated with compressed air and, in expanding, forced off the wheels provided for deck take-offs and ground landings.

Made in liquid and semiliquid form, Leadolene Klingfast is a new lubricant for wire rope that can be applied by spraying, brushing, or troweling. It is said to prevent water from penetrating between the strands, to exclude dirt and dust, and to be serviceable at temperatures as low as minus 40°F. That rope so treated at the factory may receive the same treatment subsequently, the company provides buyers with specifications of the lubricant. Klingfast is available in colors so ropes can be identified.

Among the spirally formed tubular products being made under the name Spiralok by the newly organized B & M Manufacturing Company is one with an improved interlocked spiral joint. The construction, it is claimed, permits the use of lighter than normal wall thicknesses without a sacrifice in mechanical strength. Tubing can be formed of strip material ranging from carbon steel and galvanized iron to such alloys as stainless steel and Monel.

Working under a graduate fellowship at the ceramics research station of Rutgers University, New Brunswick, N.J., William H. Bauer has developed a product from waste materials for making building brick. The basic ingredients are fly ash and slag of which huge quantities can be obtained by placing soot precipitators in industrial smokestacks and from the bottoms of furnaces burning powdered soft coal. Our public utilities alone can provide two million tons annually, it is reported. By the process, slag and ash are ground and mixed with a plasticizer and water, forced through a deaerating extruder, and molded into bricks, which are dried and fired in kilns. Equipment now used in brick plants is suitable for the work, and firing changes the dark colors of the raw materials to various shades of red. The new product is said to be cheaper and stronger than that made of clay and should help to alleviate not only the building-material shortage but also the smoke nuisance, which is still a major problem in some industrial areas.



V-BELTS BY THE YARD

V-belting now comes in endless rolls like ribbon. Pieces can be cut to proper length and fastened together after they have been fitted to an air compressor or other machine. The picture shows a cutter made by Charles A. Schieren Company to serve as an aid in splicing leather V-belts with factory precision. It cuts on the bias, leaving long tapering ends for joining by hooks or special fasteners.

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"When it comes to economy of labor and tools on piping system installations ... you can't beat the 'two-bolt' simplicity of Victaulic COUPLINGS!

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"So, if you want to save money and man-hours installing piping systems ... make it VICTAULIC! And remember, Victaulic Full-Flow Tees, Elbows and other FITTINGS lower pumping costs and *increase delivery!*"

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Industrial Literature

Abrasive products for the pulp-and-paper industry are described in a 48-page bulletin obtainable from Norton Company, Worcester 6, Mass. Items manufactured by the firm include pulpstones, sharpening stones, and saw-gumming wheels.

Logan Engineering Company, 4901 Lawrence Avenue, Chicago, Ill., offers a new bulletin, No. 147, on its Aridifier for the removal of moisture, oil, dirt, and scale from compressed air. Tables, charts, and drawings give data on selection and installation.

Henry Vogt Machine Company, Tenth and Ormsby Streets, Louisville, Ky., has issued a bulletin describing its line of water-tube boilers. These are available in bent-tube or straight-tube types and are designed to burn solid, liquid, or gaseous fuels. Bulletin is mailed upon request.

Application of replaceable air filters in ventilating and air-conditioning systems is explained in a bulletin obtainable from American Air Filter Company, Inc., Louisville 8, Ky. Descriptions and illustrations of the varying types accompany the engineering, maintenance, and installation data.

Of possible interest to laymen is an illustrated booklet entitled *The ABC's of Wrought Iron*. Nontechnical terms are used to tell what wrought iron is, how it is made, what properties it possesses, and the uses to which it is put. The booklet may be obtained from A. M. Byers Company, Pittsburgh, Pa.

A belt-type grinding and polishing machine for metal parts with contoured surfaces is described in a bulletin released by Porter-Cable Machine Company, 1714 North Salina Street, Syracuse 8, N. Y. The abrasive belt used is flexible and passes over a contact roll shaped to fit the work being finished.

Wheelco Instruments Company, 847 West Harrison Street, Chicago, Ill., has released Educational Bulletin No. 7 to explain the company's new strip-chart recorder. Covering specifications, mounting dimensions, and operation of the Electronic Scriber, the bulletin may be useful to the instrument engineer as well as to anyone interested in automatic process control.

A handbook on the selection, sizing, layout, and installation of metal-tubing circuits is available from Parker Appliance Company, 17325 Euclid Avenue, Cleveland, Ohio. The 76-page book covers all types of tubing systems and includes sections on choice of components, manipulation of flaring and bending tools, and recommended installation procedures.

Bulletin No. 277-2 of the Foxboro Company, Foxboro, Mass., covering pneumatic control valves and controller accessories, has been issued in a new edition of 36 pages. Tables and formulas for determining the correct size of valve for a given installation are included, as well as a color page showing that enamel finishes on Stabilflo valves correspond to the color code of the American Standards Association.

Engineering data on the design and installation of Tannate-Rockwood drives is contained in a booklet issued by J. E. Rhoads & Sons, 35 North Sixth Street, Philadelphia 6, Pa. Methods of computing motor overhang, belt sizes, and bearing pressures are given for the Rockwood drive, which consists of a pivoted motor mount equipped with springs which permit the motor to maintain proper tension on the belt drive.

Bulletin 516-D covers the line of rolled-shell, shaftless, squirrel-cage induction motors manufactured by Louis Allis Company, Milwaukee 7, Wis. Details of electrical and mechanical features, mountings, ventilation, and applications of built-in motor drives to industrial machinery are included.

Among the many new products developed for the war effort and put to peacetime use is synthetic-rubber packing, known for its capacity to withstand temperature extremes at low pressures. Data on the subject have been compiled by E. F. Houghton & Company in the form of a 112-page handbook. Covering the design and application of synthetic-rubber packings of all types, both fabricated and homogeneous, the book may be obtained from the company at 303 West Lehigh Avenue, Philadelphia 33, Pa.

To simplify selection of the right brush for each painting job, a 76-page, 3-color catalogue has been issued by Osborn Manufacturing Company. A section devoted to factors involved in brush selection discusses such topics as brush characteristics, operating conditions, surface speeds, and equipment requirements. A description of the Osborn line of power, paint, varnish, and maintenance brushes is included. The publication may be had by requesting Catalogue No. 200 from the manufacturer at 5401 Hamilton Avenue, Cleveland 14, Ohio.

Allis-Chalmers Manufacturing Company, Milwaukee 1, Wis., has published a 144-page indexed catalogue to facilitate the selection of proper V-belt drives by persons unfamiliar with the subject. More than 22,000 pre-engineered stock drives for 1 to 150 hp. are listed. The term preëngineered means the calculation by which a V-belt drive is made to meet a certain set of conditions including horsepower, motor speed, drive ratio, and overload factor. Wherever similar conditions exist, the same drive can be used without the necessity of individual engineering.

An engineering data book covering the fundamentals of pipe- and fin-coil calculation has been published by Rempe Company, 340 North Sacramento Boulevard, Chicago 12, Ill. Intended to provide draftsmen and designers with helpful information concerning heating and cooling problems, the book gives heat transfer "K" factors for conditions from minus 60°F. to plus 350°, presents recommended air velocities and fin spacing for fin-type coils, and shows how to calculate and design pipe- and fin-coils for all common heating and cooling loads. Price of the 34-page book is $1.50.

Details of a new lightweight rock drill are given in Form 4065 issued by Ingersoll-Rand Company, 11 Broadway, New York 4, N. Y. Designated as the J-10 Utility Jackhamer, the tool was designed for plant maintenance and general work on ladders or scaffolds where lightness is desirable. Total weight of the J-10 is 14 pounds, and features include automatic rotation and the use of standard Jackbits, drills, chisels, gouges, and moils. There are also available a 16-page bulletin (Form 3014-B) describing the company's Type PL and M aftercoolers, together with the principles, applications, and benefits of aftercooling, and Form 10311 dealing with its new Type SS turbocharged diesel engines which are built in three sizes of six, seven, and eight cylinders and range from 675 to 900 hp.

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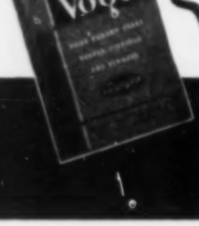

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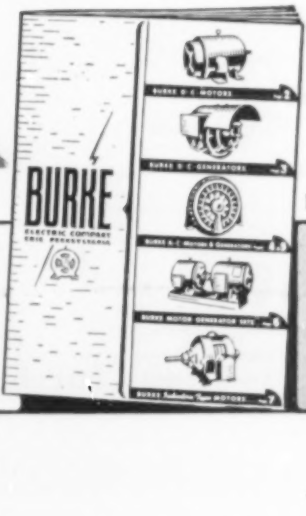
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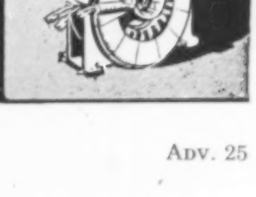

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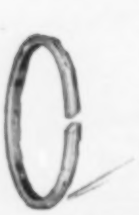

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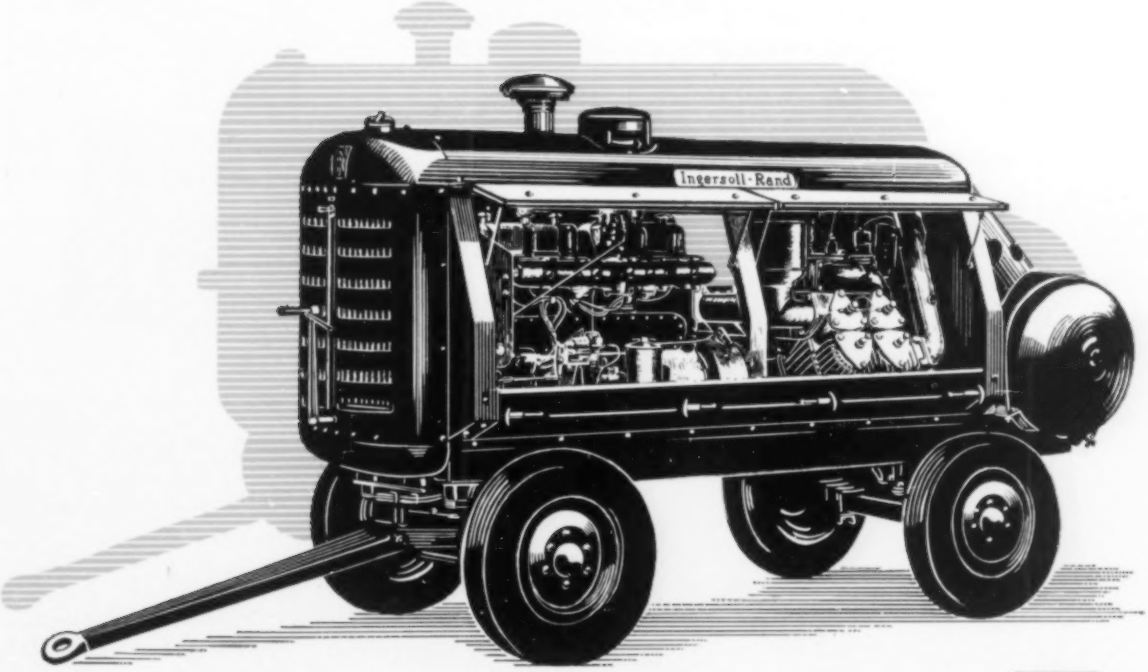

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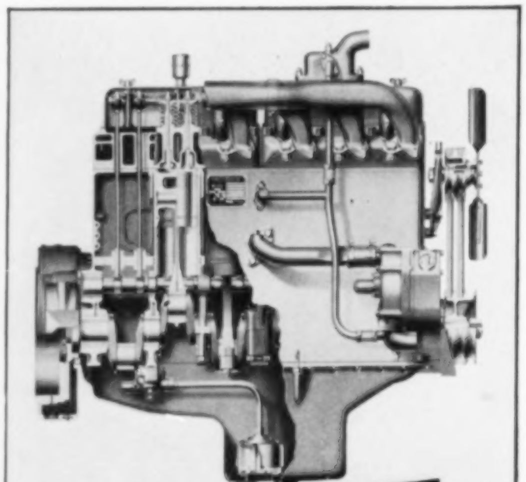

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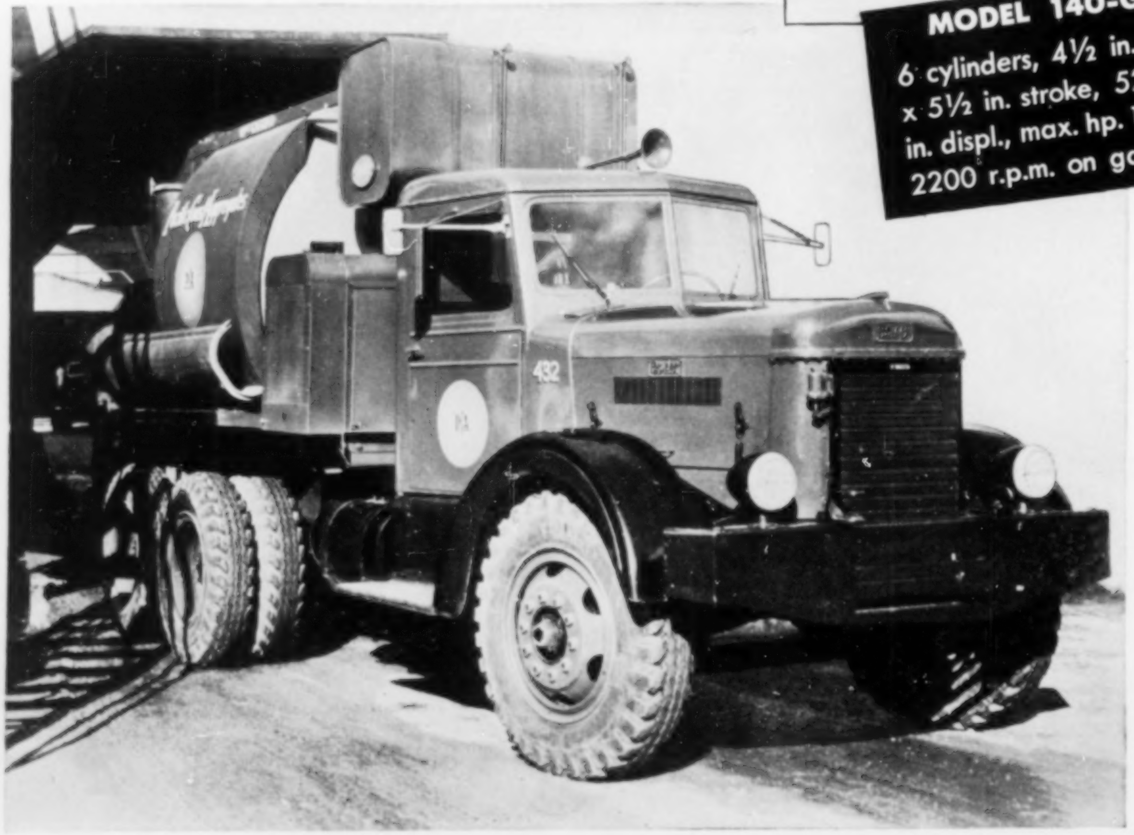

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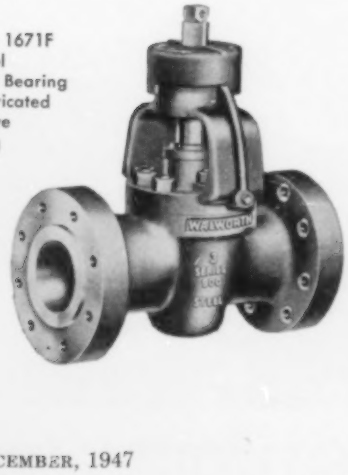

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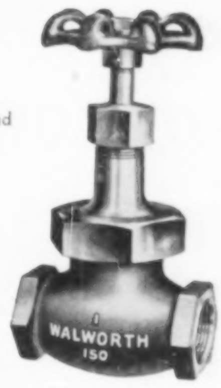
Steel
Valve

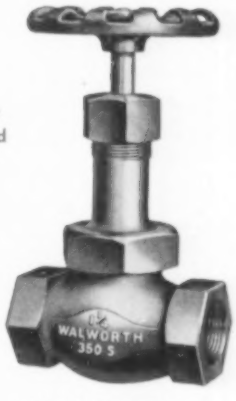
WALWORTH
STEEL

No. 95
150-Pound
Bronze
Valve



Renewable Disc

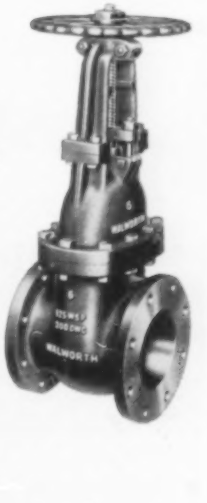
No. 225P
350-Pound
Bronze
Valve



"500 Brinell" Seat & Disc

No. 709
Iron Body
Saddle
Gate
Valve

No. 726F
Iron Body
Wedge
Gate
Valve



Smooth and Continuous Operation hinges on the *Lubrication System*

MODEL-OIL
THE MOST DEPENDABLE METHOD OF LUBRICATION EVER DEVELOPED
Fresh Oil
DROP from the
LUBRICATOR
BULLETIN
Fresh Oil
DROP BY DROP
UNDER PRESSURE FROM
CV
MADISON-KIPP LUBRICATOR
THE MOST DEPENDABLE METHOD OF LUBRICATION
Fresh Oil...
BY THE MEASURED DROP
MADISON-KIPP MODEL SVD LUBRICATORS
BULLETIN L-3401
LUBRICATORS
PORATION

MADISON-KIPP

MADISON-KIPP is the most dependable lubrication system ever developed. It is applied as original equipment on America's *finest* machine tools, work engines, and compressors . . . You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy where oil under pressure fed drop by drop can be installed.

- *Skilled in* DIE CASTING *Mechanics*
- *Experienced in* LUBRICATION *Engineering*
- *Originators of Really High Speed* AIR TOOLS

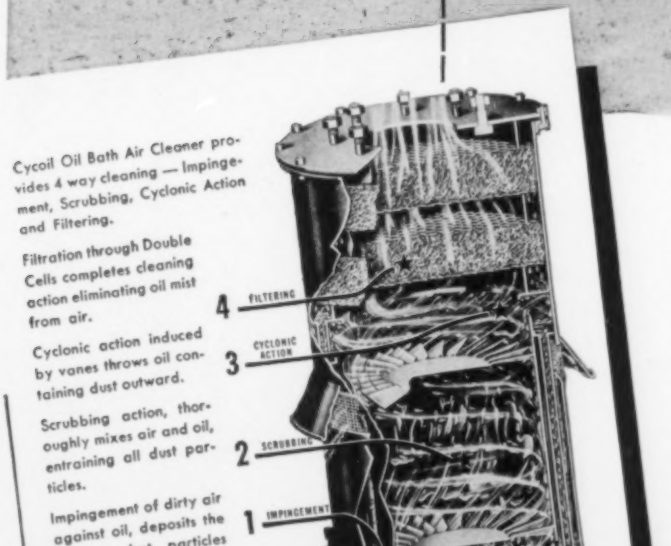
MADISON-KIPP CORPORATION

202 WAUBESA STREET, MADISON 4, WISCONSIN, U. S. A.

ANCIENS ATELIERS GASQUY, 31 Rue du Marias, Brussels, Belgium, sole agents for Belgium, Holland, France, and Switzerland.

WM. COULTHARD & CO. Ltd., Carlisle, England, sole agents for England, most European countries, India, Australia, and New Zealand.

Surrounded by dust
but safe with Cycoil



Cycoil Oil Bath Air Cleaner provides 4 way cleaning — Impingement, Scrubbing, Cyclonic Action and Filtering.

Filtration through Double Cells completes cleaning action eliminating oil mist from air.

Cyclonic action induced by vanes throws oil containing dust outward.

Scrubbing action, thoroughly mixes air and oil, entraining all dust particles.

Impingement of dirty air against oil, deposits the heavier dust particles immediately. Oil and air mixture then passes upward with whirling motion through vanes to succeeding cleaning steps.

THIS compressor station is surrounded continually by heavily dust-ladened air yet the engines are free from the damaging effects of grit and dirt. The answer is obvious—each and every unit enjoys the permanent protection of a Cycoil Oil Bath Air Cleaner.

Nothing short of perfection gets by in the dust country. Cycoil delivers practically 100% cleaning efficiency because it is a heavy-duty oil bath cleaner of large dust-holding capacity designed and built for this exacting service. Over 90% of the total fine dust content of the air is trapped in a Cycoil even before reaching the filter cell. Positive oil circulation for continued self-cleaning action, plus the additional filtration to be had in the filter pads, makes for approximately 100% clean air.

"Play it safe with Cycoil" has become a by-word with operating and maintenance men the world over. Reasons why are contained in Bulletin 130-D. Write for it today.

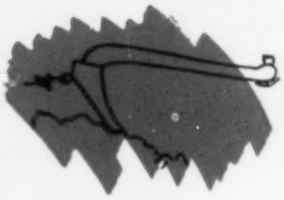
AMERICAN AIR FILTER COMPANY, INC.
402 CENTRAL AVENUE • LOUISVILLE 8, KY.
In Canada: Darling Bros. Ltd., Montreal, P. Q.

AAF

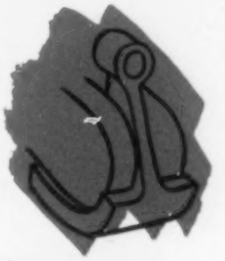
Cycoil OIL BATH AIR CLEANER
AND INTAKE SILENCER

Eimco FOLDING

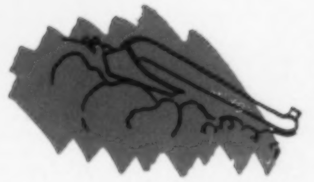
SCRAPER



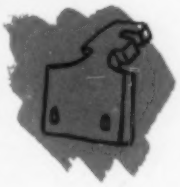
The blade can be opened or closed at the will of the operator with proper hoist controls, even opened on the return pull, if desired.



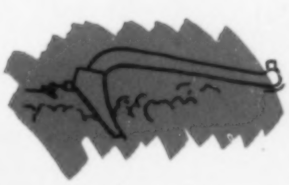
Cast eye held between the arms incorporates a wear shoe at the bottom. The rope runs free through this eye to a hitch at the top of the scraper blade.



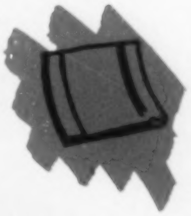
The folded scraper rides back over the muck adjusting itself to the angle of the muck. Opening and closing the blade helps it step back over large rocks.



Simple hitch fastened to the back of the scraper. Looping extremely stiff cable to this hitch is a very simple operation.

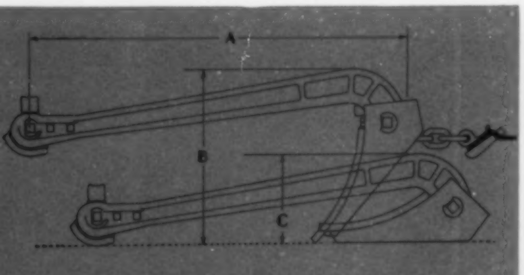


When the blade is opened by the operator and the forward motion started, the scraper begins to dig immediately.



The blade of the scraper which fastens to the scraper back is reversible—average life about 150,000 tons with about 50 to 60 ft. pull.

Simple quick hitch on tail rope is same as on pull rope — makes for quick repairs and efficient operation.



SIZE	36"	42"	48"	60"	72"
A	58"	58"	76"	95"	114"
B	25"	25"	35"	45"	51"
C	12"	12"	18"	26"	26"
Approx. Wt. Lbs.	600	700	1600	3800	5600

EIMCO

THE EIMCO CORPORATION

Executive Offices and Factories — Salt Lake City 8, Utah:
Branches — 67 Wall St., New York 5 — 3319 So. Wallace, St.,
Chicago 16—Mills Bldg., El Paso—1217 - 7th St., Sacramento 14

A151

POWELL makes a *complete* line of valves for COMPRESSED AIR SERVICES

More than a century ago, the Wm. Powell Company adopted a definite, long-range policy, namely, to concentrate on making valves—and valves only—for all branches of industry. As a result Powell has been able, through the years, to meet each new flow control requirement as it has arisen. Thus at any given time in more than a hundred years, the Powell Line has always been *complete.*

Today, the Powell Line of Valves for Compressed Air Services includes not only valves of all required types, designs and sizes for controlling the flow of compressed air but also the flow of water used for cooling air compressors.

The Wm. Powell Co., Cincinnati 22, Ohio

DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES

MS
POWELL
125
WSP

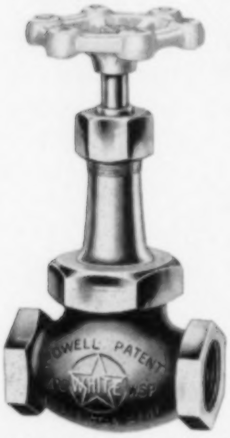
125-pound Iron Body Bronze Mounted Gate Valve. Flanged ends, outside screw rising stem, bolted flanged yoke, bronze seat rings and taper wedge solid disc.

M.S.
POWELL
125

125-pound Iron Body Bronze Mounted Globe Valve. Flanged ends, outside screw rising stem, bolted flanged yoke, bronze renewable seat and disc holder, with renewable vulcanized composition disc.

POWELL
UNION DISC

150-pound Bronze Horizontal Lift Check Valve. Screwed ends, screwed cap and renewable vulcanized composition disc.



200-pound Bronze Globe Valve. Screwed ends, union bonnet, renewable seat and regrindable, renewable, wear - resisting "Powellium" nickel-bronze semi-cone, plug type disc.

POWELL PATENT
WHITE
200 W.P.

200-pound Bronze Dash Pot Check Valve. Because of the cushioning effect of the plunger in the dash pot, the seating of the disc is practically noiseless.

POWELL
UNION DISC

150-pound Bronze Globe Valve. Screwed ends, union bonnet and renewable vulcanized composition disc.

POWELL
PAT.
WHITE
200 WSP

200-pound Bronze Gate Valve. Screwed ends, inside screw rising stem, union bonnet and renewable, wear - resisting "Powellium" nickel bronze disc.

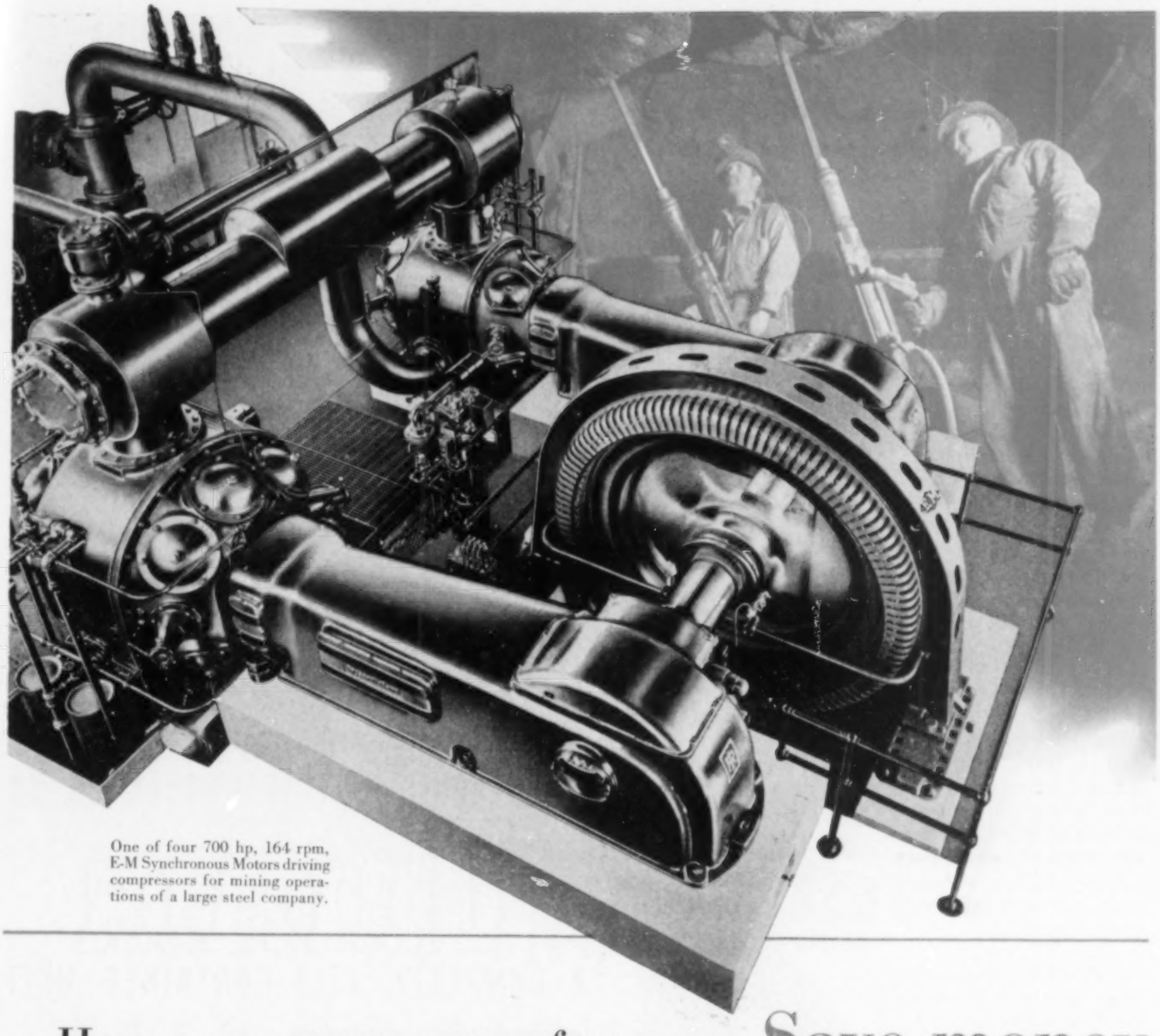
M.S.
POWELL
150
SP

150-pound Iron Body Bronze Mounted Lift Check Valve. Screwed ends, bolted flanged cap, renewable bronze seat and union vulcanized composition disc.

M.S.
POWELL
125

125-pound Iron Body Bronze Mounted Globe Valve. Flanged ends, outside screw rising stem, bolted flanged yoke and regrindable, renewable bronze seat and disc.

POWELL VALVES



One of four 700 hp, 164 rpm, E-M Synchronous Motors driving compressors for mining operations of a large steel company.

How compressor manufacturers Save money

. . . for the user of Air Power

E-M

SYNCHRONOUS MOTORS
are the first choice for
COMPRESSOR DRIVES

- **LOWEST COST** operation because of inherently efficient design.
- **DIRECT DRIVE** for simplicity and minimum maintenance.
- **HIGH STABILITY** to keep motors going despite voltage dips.
- **HIGH POWER FACTOR** for preferential rates, improved voltage regulation.
- **LOWEST INSTALLATION COST** for only two basic motor parts, stator and rotor.
- **MAGNETIC CONTROL** with push button starting. "Conscious control", provided by Polarized Field Frequency Relay, cooperates with the motor for smooth starts.

● Leading compressor manufacturers, experienced in furnishing millions of horsepower, recommend Synchronous Motors for most efficient large compressor operation. They have found that the qualities of a Synchronous Motor mean real savings to the user of air power. That's why motor and compressor are designed and built with matching characteristics . . . and why the Synchronous Motor is the standard drive for large compressors.

E-M pioneered the development of the Synchronous Motor, was one of the first to apply its use to compressors. Today, E-M motors are used on a big share of all compressor drives. Their selection for such important jobs as the one pictured here is based largely on high efficiency and resultant savings.

Installation after installation confirms E-M Synchronous Motors' recognized dependability, wins for them their reputation as "the most efficient drive in industry".

ELECTRIC MACHINERY MFG. COMPANY
MINNEAPOLIS 13, MINNESOTA

E-M

A2049

PLAY SAFE!

BUY *LE-HI* HOSE COUPLINGS
FOR **HIGH PRESSURE**
AIR LINES

LE-HI Series 150-B. The only Universal Type Hose Coupling with the patented "Safety-Locking" feature that positively prevents accidental uncoupling. Especially designed for compressed air service.

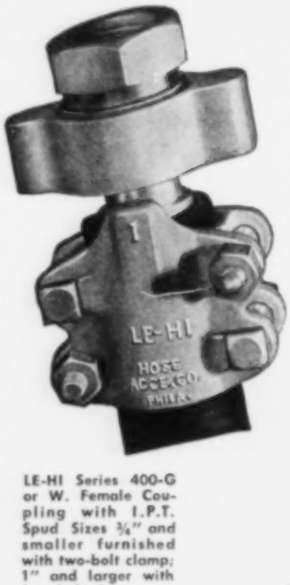
Construction men take no chances. They know that every length of hose and every hose coupling is a vital factor in the safety of both men and equipment.

When you buy LE-HI, you buy the *safety you must have*—because there are no safer, *tougher* hose couplings on the market than LE-HI. . . .

SAFER, because of LE-HI's advanced design . . . shanks and clamps that won't "blow off" . . . LE-HI Series 150-B, the only Universal Type Couplings with the patented "Safety-Locking" feature that positively prevents accidental uncoupling. . . .

TOUGHER, because of rigid standards of quality and workmanship . . . *extra-heavy construction* to take the beating of a tough business—and keep on taking it!

Construction is booming everywhere. Be ready for your part in the program with *safe, efficient* equipment. And be sure that every air line has LE-HI—the SAFER, TOUGHER Hose Couplings!



LE-HI Series 400-G or W. Female Coupling with I.P.T. Spud Sizes ¾" and smaller furnished with two-bolt clamp; 1" and larger with four-bolt clamp.

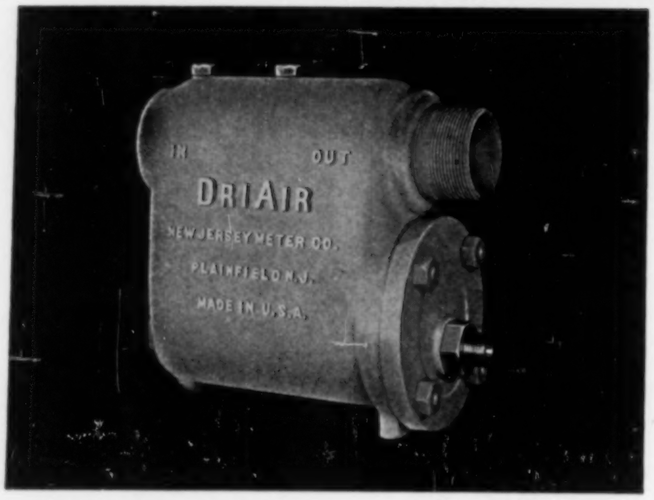
Sold Only Through Leading Distributors and Rubber Manufacturers

LE-HI
HIGH and LOW PRESSURE
HOSE COUPLINGS

LE-HI MAKES A GOOD CONNECTION

HOSE ACCESSORIES COMPANY
2716 NORTH 17th STREET • PHILADELPHIA 32, PA.

DEPENDABLE PNEUMATIC SERVICE



WHEN EQUIPMENT IS PROTECTED BY

DRIAIR

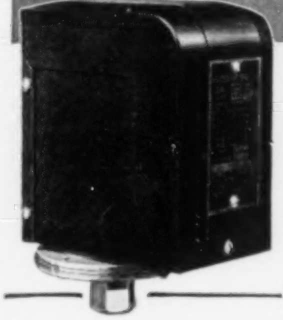
A COMPLETE SELF-CONTAINED UNIT

DriAir may be installed by suspending it from the piping, without any other support, or may stand on the floor near equipment being protected

DRIAIR speeds production by separating and automatically ejecting the condensed water and oil from the air. DriAir collects dirt and rust from the air lines and delivers clean dry air to the tools, thus reducing wear and prolonging their life. All internal parts are made of bronze or copper – resistant to corrosion and practically permanent. Copy of Bulletin DA fully describing the operation of DriAir sent on request.

NEW JERSEY METER COMPANY
PLAINFIELD, NEW JERSEY

for AIR COMPRESSORS *and* WATER PUMPS



Class 9013
type ASG

PRESSURE SWITCH

250 lbs. pressure limit
10 to 45 lbs. differential

● A standard controller for motor-driven air compressors and water pumps. Heavy contacts, with silver permanently bonded to the heavy bronze backing. Generous electrical ratings. Four ⅞ inch knockouts for ½ inch conduit are provided for convenient wiring.

Modern black enameled steel cover. Corrosion-resisting inner parts. High-grade impregnated fabric diaphragm. Oil-resisting type also available.

Write for Bulletin ● Illustrations, specifications of Square D pressure switches and related devices. Address Square D Company, 4041 North Richards Street, Milwaukee 12, Wis.

SQUARE D COMPANY
DETROIT · MILWAUKEE · LOS ANGELES
SQUARE D CANADA, LTD., TORONTO, ONTARIO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

NORGREN LUBRICATORS

Don't Cost
They Pay

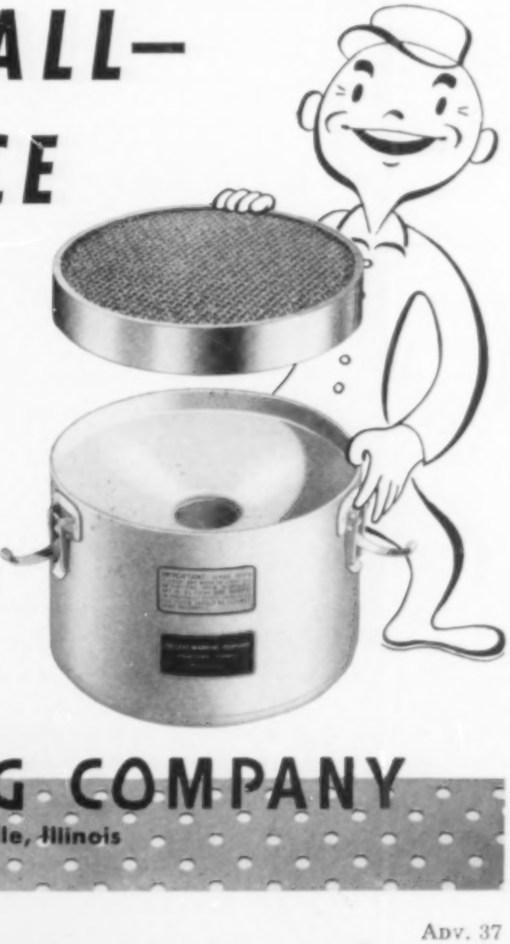
Oil the air that drives the tool or cylinder. Smoother operation, less wear, greater protection against rust and corrosion. Automatic. Adjustable. Proved.

Write for catalog 400

C. A. Norgren Co., 222
Santa Fe Drive, Denver 9,
Colorado.

Norgren

EASY TO INSTALL—EASY TO SERVICE



You've never seen an intake Cleaner-Snubber that's as easy to use as this one. Installation is quick because no angles or fittings are necessary. You can mount this unit in any position ... even upside-down ... without impairing its efficiency.

If desired, you can install this unit out-of-doors with the element down to prevent the entrance of rain or snow.

Servicing is just as simple. Loosen two or three snap fasteners and lift out the filter element—and the job is done. Filters are as quickly replaced, because there are no screws or covers to bother with or lose. The snap fasteners can't come off.

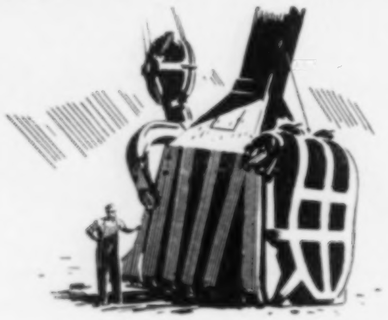
Operation of this unit provides both cleaning (through the nonferrous metal impingement type filter) and silencing (by the surge Snubber built into the body of the unit). Write for bulletin on Model ICS.

BURGESS-MANNING COMPANY
749-P East Park Ave., Libertyville, Illinois

Know the Facts About Your Field

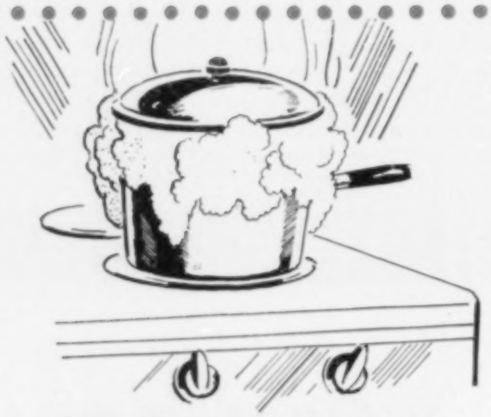
1 WHAT IS THE THICKEST VEIN OF BITUMINOUS COAL?

☐ 50 feet ☐ 75 feet ☐ 100 feet



2 WHAT IS THE SIZE OF THE LARGEST POWER SHOVEL BUCKET?

☐ 40 cubic yards ☐ 55 cubic yards ☐ 25 cubic yards



3 WHAT MINERAL "GROWS" 16 TIMES WHEN HEATED?

☐ Vermiculite ☐ Asbestos ☐ Chromite

4 WHAT IS A GELAMITE?

☐ An explosive for mining or quarrying

☐ Soft, iron-bearing ore

☐ An insect that feeds on earth or rock

ANSWERS

1 A vein of bituminous coal, now being worked at the Elkol Mine, Elkol, Wyo., is 100 feet thick at points and is from 20 to 50 feet thick along the working face. This rich vein is reputed to be thickest in the world.

2 Forty cubic yards is the size of the world's largest bucket now in operation on a shovel at the Hanna Coal Company, near Cadiz, Ohio.

3 Because it often expands or exfoliates to 16 times its original size when heated, the non-metallic mineral, Vermiculite, has found widespread use as an insulating material. Recently, this valuable mineral has also been employed extensively as a light-weight aggregate in concrete.

4 Gelamite® is the name of a series of semi-gelatin explosives made by Hercules. In mining, quarrying, and excavating, they effectively and economically replace gelatin dynamites for many blasting jobs. The Gelamites are just one example of the wide range of explosives and blasting supplies Hercules produces to meet the requirements of every blasting job.

HERCULES POWDER COMPANY

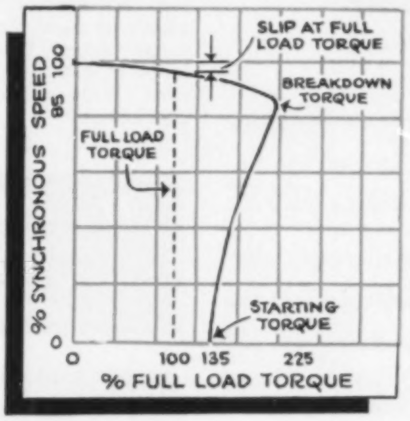
INCORPORATED

932 King Street, Wilmington 99, Delaware

®REG. U. S. PAT. OFF. BY HERCULES POWDER COMPANY

Here's *One* Way to Choose Motors...

Sure, Your Local "Swami" can pick a motor for you in an instant! But if you want motor counsel you can *bank* on . . . you'll consult a reputable motor manufacturer. In place of crystal-ball gazing, he'll advise you to follow *practical* and *orderly* steps in arriving at *right* motor selection. For example . . .



First, Study Your Power Supply . . . voltage, frequency, number of phases; the p.f. required by your utility. Judicious selection will help balance your motor capacity . . . lower power costs. And check the voltage regulation — choose motors with enough torque to start and carry the load. Next . . .

Study the Driven Machine and surroundings. What hp? What starting torque? Will you need a horizontal or vertical motor — direct-connected, belt-driven or gear-operated? How about surroundings — ambient temperature, moisture, corrosion, dust. Each calls for a particular type of protection. Now . . .

MOTOR CHARACTERISTICS

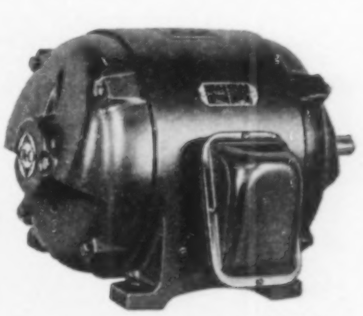
Study Your Motor Characteristics. *A-c motors?* For most jobs they're satisfactory and economical. *D-c motors?* For wide speed range; for fast acceleration or reversal they may prove your best bet. *Synchronous motors?* When applicable they give you low-cost p.f. correction. You're *still* undecided? Call in your nearby Allis-Chalmers motor expert. He'll be glad to help you decide—with recommendations backed by 50 years of motor-building!

Wise Motor Choice Saves Power; Ups Profit!

Yes, crystal-ball gazing methods are out when you're trying to get *maximum* return on your electric motor investment. Slip-shod selection usually results in over-capacity, high power and maintenance bills — the kind of costs that in the competitive era of tomorrow you won't be able to afford!

That's why it pays to know more about *all* types of motors . . . their operation . . . limitations . . . maintenance. And there, too, is where your Allis-Chalmers motor expert can be of real help! Allis-Chalmers, Milwaukee.

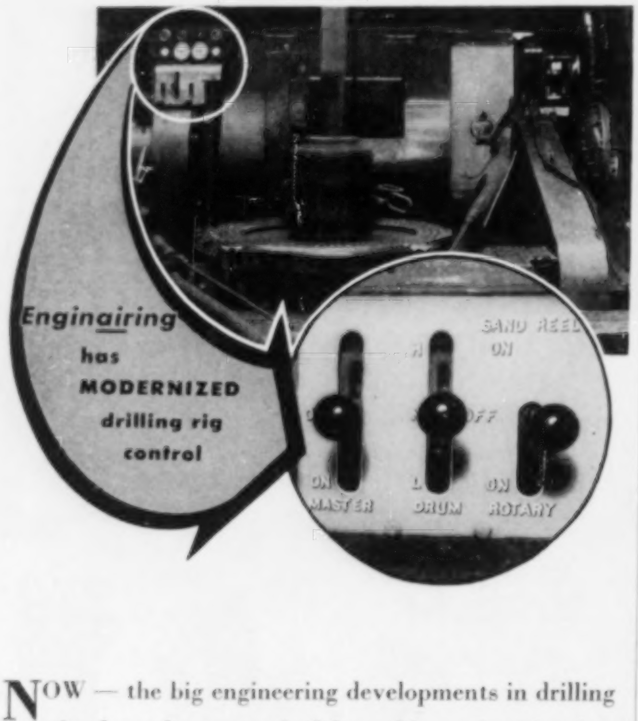
A 2328



1847 1947
A CENTURY OF SERVICE
to Industry
THAT MADE
America Great

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment-
Biggest of All in Range of Industrial Products



NOW — the big engineering developments in drilling rigs have been matched by a big enginairing improvement, that provides completely modern controls.

W·A·B· Controls substitute a few small valves, that can be moved with a finger-touch, for yesterday's levers and pedals. The illustration shows the simplicity and compactness of the master, drum and rotary controls.

Another big advantage is in the engine throttle control. W·A·B· devices permit a group of engines to be accurately and automatically load-balanced when compounded. This assures the most efficient utilization of available power, and eliminates the excessive wear and maintenance that may result when engines do not share the load. A change from compound to individual engine operation can be made in a moment.

Most of the leading manufacturers offer rigs equipped with W·A·B· Controls. For tops in performance, specify W·A·B· apparatus.

PNEUMATIC CONTROLS

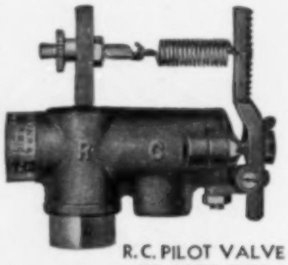
WABCO PACKING

WESTINGHOUSE AIR BRAKE COMPANY

Industrial Division - - - Wilmerding, Pa.

R. C. PILOT VALVES For POSITIVE CONTROL

R-C Unloader Pilot Valves (plain or strainer type) are standard on many leading compressors . . . installed as replacements on thousands of compressors in all parts of the U.S.A. and overseas. The R-C valve—positive in action—cannot chatter . . . it's always in open or closed position. Adjustment is provided for any unload-to-load range from 3% to 30% of maximum receiver pressure. Install an R-C Unloader Pilot valve—let performance prove its value. Specify air pressure and range of on-and-off operation desired. Write for price and recommendation.


R. C. PILOT VALVE
STRAINER TYPE

R. CONRADER CO.

1207 FRENCH STREET - ERIE, PA.

PILOT VALVES for Portable and Stationary Air Compressors provided with Unloaders

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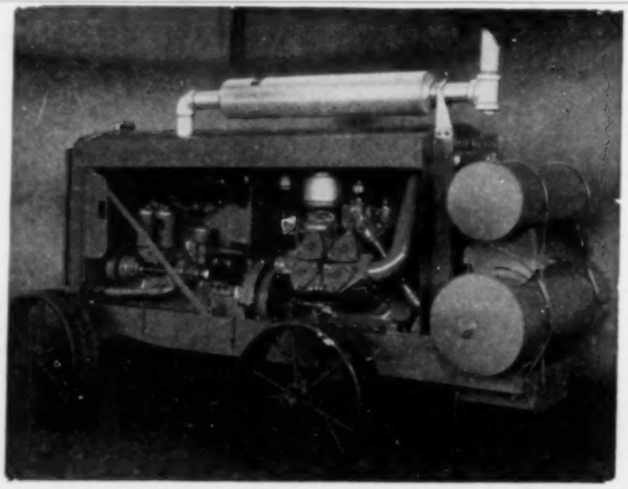


MAXIM EQUIPPED FOR GOOD PUBLIC RELATIONS

A portable compressor is apt to spend its service life in many locations where noise is a nuisance to nearby homes and offices. It is good public relations to provide adequate silencing and good practice to choose Maxims for this job. For superior silencing of engine exhaust and intake, compressor intake, steam or air blow-off; for spark arresting or silencing with the heat recovery feature, specify Maxims. Detailed bulletins on request.

THE MAXIM SILENCER COMPANY
61 HOMESTEAD AVENUE, HARTFORD 1, CONN.

MAXIM SILENCERS

KOH-I-NOOR
L.&C. HARDTMUTH

.000001 TOLERANCE —

That's "drawing the line Fine"!

Today — right now — make the "Tolerance Test" with **KOH-I-NOOR Drawing PENCILS.** See how they create those fine tolerances on paper, so often demanded by American industry. See those lines come up crisp — clear — sharp. And very important, too — see their "staying power". For in the long run, you'll find **KOH-I-NOOR Drawing PENCILS** most economical.

17 uniform degrees to choose from — smartly packaged in a permanent lithographed container — one dozen to each package.

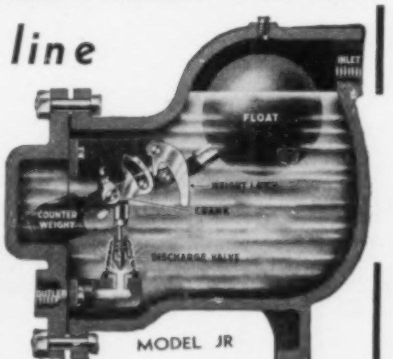
"Send for Leaflet No. 19"

KOH-I-NOOR

The RIGHT pencil for the RIGHT job
KOH-I-NOOR PENCIL COMPANY, INC., BLOOMSBURY, NEW JERSEY

Put a
NICHOLSON AIR TRAP
on a test line

Here's What
You'll Find



Air traps for all applications, and for pressures to 1500 lbs.

POSITIVE FLUID SEAL assures clean air without loss of medium.
FAST ACTION, due to intermittency.
RUGGED, to take unavoidable abuse.
MINIMUM MAINTENANCE - Not easily affected by dirt, pulsation, etc.; easily connected.
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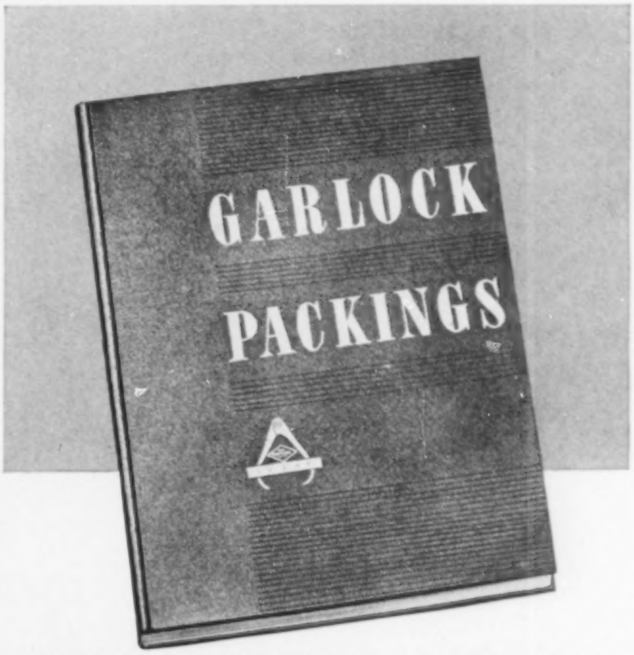

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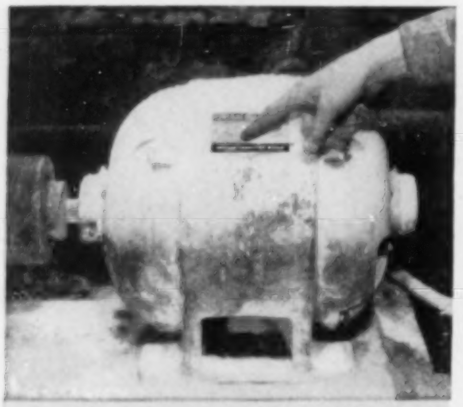

Keeps Its Bearings in "Dust Bowl"

Ordinarily, we wouldn't recommend that you use an open motor on a job like this. This Tri-Clad motor drives a boiler-feed pump in the National Gypsum Company plant at Clarence Center, N. Y. The air surrounding the motor is constantly filled with gypsum dust which must be kept out of the bearings. And it *has* been kept out of the bearings of this Tri-Clad motor, thanks to its specially designed bearing housing and seals. We believe that the Tri-Clad motor you see here proves that even where dust, moisture, or some other hazard is extremely severe for open-motor applications, the extra protection afforded by Tri-Clad motor construction results in longer motor life and lower upkeep.

The toughest motor yet!

The Tri-Clad totally enclosed, fan-cooled motor is designed for use in adverse atmospheres — in iron dust, out of doors, in hazardous areas, and chemical atmospheres. It gives you these important construction features:

- A cast-iron, double-wall frame which completely encloses and protects the windings and punchings.
- A nonshrinking compound around motor leads which protects motor interior from dust and moisture.
- A rotating labyrinth seal which further protects the motor interior from damage by foreign matter.

TRI CLAD

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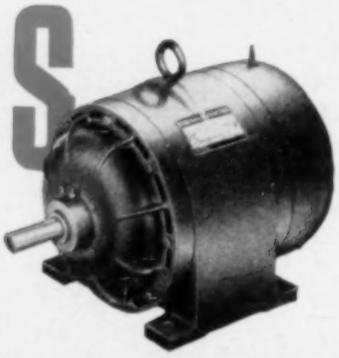
ON 1,220,000 MOTORS



TRI CLAD

THE SYMBOL OF

EXTRA PROTECTION

Announcement of the Tri-Clad motor, back in 1940, ushered in a new concept of general-purpose motor design. Substantially increased horsepower-per-frame-size was one feature. Smarter appearance was another. But what really sold more than a million Tri-Clad motors is the *extra protection* we built into them.

Today, with the "family" including dripproof motors, vertical motors, gear-motors, capacitor-motors, and totally enclosed motors, Tri-Clad motor is, more than ever, the motor that means basic protection, dependable performance, and minimum upkeep. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

EXTRA PROTECTION . . . AGAINST PHYSICAL DAMAGE!

Rigid cast-iron frame and end shields protect vital parts from external abuse and prevent resonance. Because they're not at the mercy of a coat of paint, they strongly resist chemical attack and dampness. Cast iron also gives you tight, *metal-to-metal* fits between end shields and frame.

EXTRA PROTECTION . . . AGAINST ELECTRICAL BREAKDOWN

Windings of Formex* wire together with improved insulating materials, reduce the chances of electrical failure. Heat is dissipated quickly — motor stays young for years and years.

EXTRA PROTECTION . . . AGAINST OPERATING WEAR AND TEAR!

Bearing design affords longer life, greater capacity, improved lubrication features. Bearing seals retain lubricant, keep out dirt. One-piece, cast-aluminum rotor is practically indestructible.

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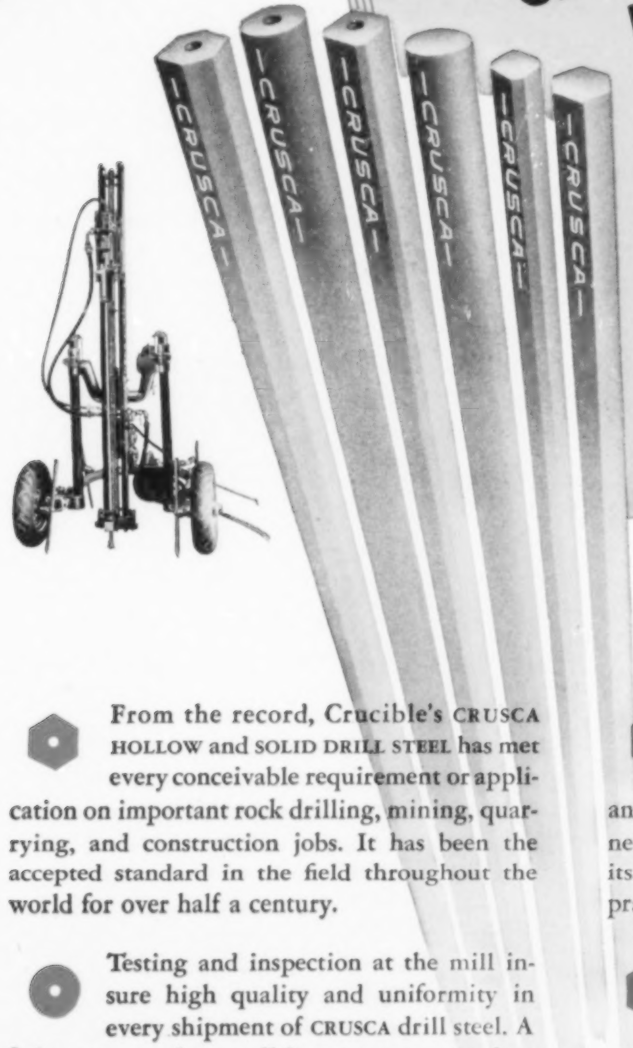

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Testing and inspection at the mill insure high quality and uniformity in every shipment of CRUSCA drill steel. A fatigue test under conditions more severe than any found in the field has been developed by Crucible's engineers and is a thorough check on every lot prior to shipment.

The low cost of CRUSCA per foot of hole is the result of excellent shank qualities, resistance to fatigue, uniformity of analysis and structure, hole concentricity, stiffness and accuracy of section. Blacksmiths praise its heating and forging characteristics. Drillers praise the way it makes hole fast.

CRUSCA drill steel is available in both carbon and alloy types . . . in three shapes . . . and in all sizes. Newly developed alloy steels are available for jack stud insertion. Whatever your drill steel problems, your local, experienced Crucible salesman can provide a CRUSCA drill steel to meet your needs.

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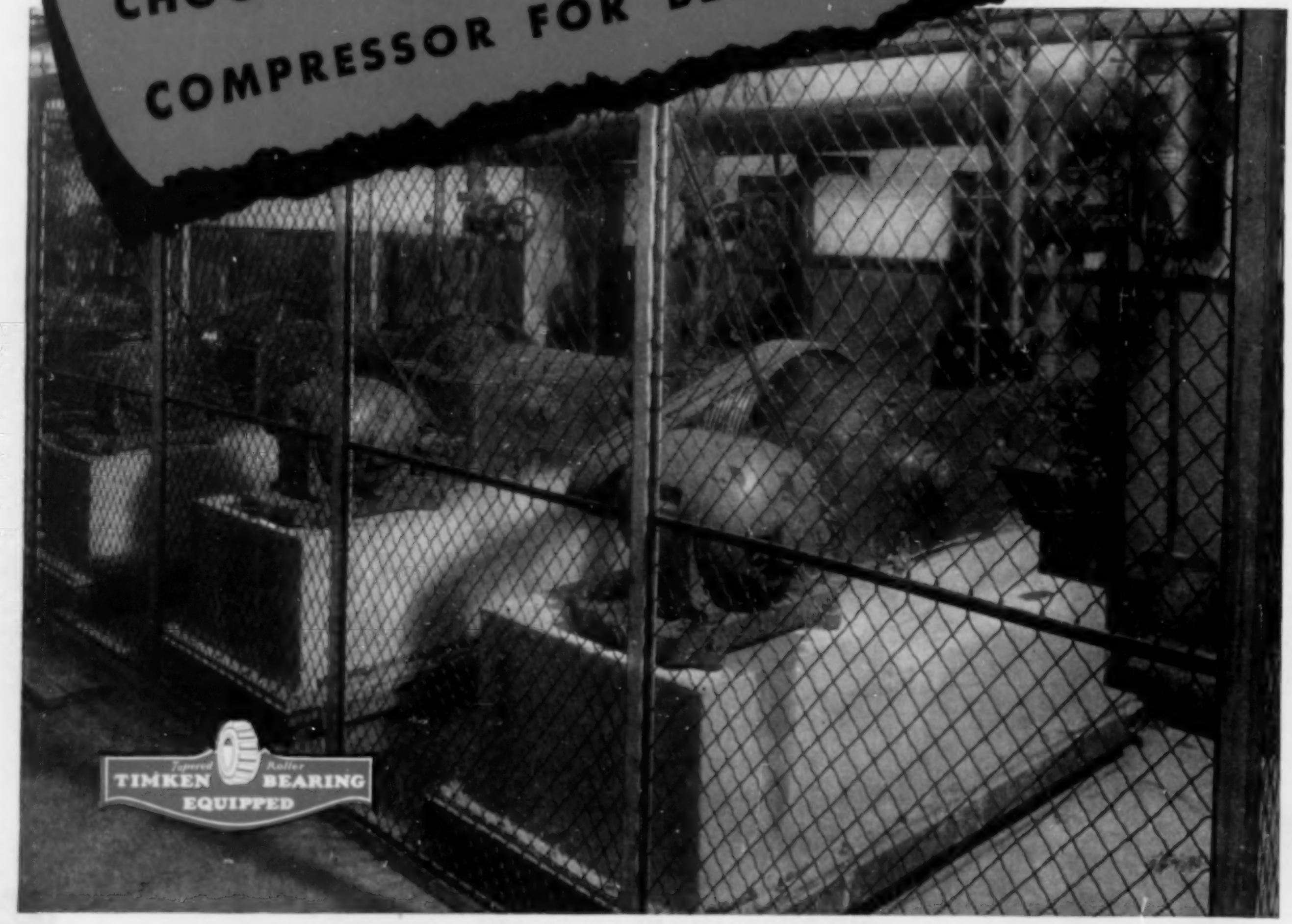

Battery of 3 Ingersoll-Rand 7 x 7 ES-1 compressors equipped with Timken Bearings supplying air for hydraulic presses in a large manufacturing plant.

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Then you will not only get a smooth-operating compressor but also one that will give the utmost in dependable, long-term service at minimum cost for operation and maintenance.

For Timken Roller Bearings are *more* than anti-friction bearings; they are radial, thrust and combined load carrying bearings and alignment preserving bearings as well; and because they are made of Timken Fine Alloy Steel, they normally last as long as the equipment in which they are installed. See that you have them in your machines. Look for the trade-mark "TIMKEN" on every bearing you use.

THE TIMKEN ROLLER BEARING COMPANY, CANTON 6, OHIO

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